MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian Service, cable and mail, 8; River and Flood service, 52, river and rainfall, 177, rainfall only, 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The storms of the month on the North Atlantic were of moderate intensity and appeared over the ocean in high latitudes. In the vicinity of the Azores high barometric pressure prevailed except from the 14th to the 16th.

In the United States the only important general storm of the month visited the Lake region and middle Atlantic and New England coasts on the 17th and 18th. This storm, in advance of which the usual warnings were displayed, was severe in the lower Lake region and on the southern New England coast, and the high wind that attended its passage flattened corn in the Ohio Valley and the Lake region.

The warm waves of the month were neither severe nor of long duration. High temperatures that prevailed generally over the country on the 1st were broken in the Eastern States by local rains on the 2d. A warm wave that appeared in the Northwest on the 6th extended over the central valleys on the 7th and reached the Atlantic coast on the 8th. High temperatures continued over the interior and eastern districts until broken by local rains and thunderstorms on the 10th, 11th, and 12th. On the 23d and 24th high temperatures again appeared in the Northwest, and the warm wave extended over the upper Mississippi and lower Ohio valleys and the western Lake region during the 25th and reached the Atlantic coast on the 26th. The temperature continued high in the Middle West during the 27th and 28th and rose, on those dates, to 100° at Fresno, Cal.

The warm wave of the 6th to 12th culminated in the Middle Atlantic States with severe local storms. At Baltimore, Md., a tornadic storm that occurred about noon on the 12th unroofed or otherwise wrecked several hundred houses. The buildings wrecked were mostly frail brick structures. On the 22d, shortly after 3 p. m., Paterson, N. J., was visited by a tornado that caused the death of three persons and destroyed property, principally in the form of small houses, valued at about $250,000.

In the early days of the month heavy rains resulted in floods in the streams of northern Texas, and on the 5th considerable damage was caused by rain in parts of Pennsylvania and western Maryland.

During the first decade of the month frost occurred at points in the middle and northern Plateau and northern Rocky Mountain districts, and on the 2d snow was reported on the Continental Divide in Montana. On the 26th and 27th frost occurred in parts of northern New England, and snow flurries were reported in the mountain regions of New Hampshire.

BOSTON FORECAST DISTRICT.

From the 1st till the 14th the weather was of the usual midsummer type, with the temperature generally above normal. During the remainder of the month there was much cloudiness, with local storms, which in some localities were of marked

violence, and temperatures uniformly below the normal. Frosts occurred on the 26–27th in some of the northern sections and snow flurries were reported in some of the mountain regions of New Hampshire. High winds prevailed along the coast on the 18th and 19th, for which warnings were issued. There was no damage to shipping, so far as known to this office. No storms occurred without warnings.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month of July was mild and no extensive storm occurred. The month opened with rainy weather in some parts of the district, especially over Texas, and showers continued until the 9th, after which dry weather prevailed, except for occasional scattered showers, until the 25th, when rainy weather set in over Louisiana and Texas and continued until the close of the month. The commencement of these rains, following two weeks' dry weather, was announced in the forecasts of the 24th, practically twenty-four hours before the rains set in. Excessive local rains occurred in Texas on the 29th and 30th.—*I. W. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

Except for squalls, which usually attend summer thunderstorms, there was but one storm of any severity which crossed the district during the month. This storm developed in the Southwest during the night of the 16th and passed across the Lakes during the 17th and 18th, causing destructive winds and doing damage. Warnings were issued well in advance and shipping interests cautioned. During the passage of this disturbance severe local storms with tornadic characteristics occurred in portions of Illinois. A severe hailstorm occurred in Chicago and vicinity on the 21st. This storm was unusual both in duration—lasting five minutes—and in the size of the hailstones, some of the stones measuring an inch in diameter, with jagged points.—*F. J. Walz, Inspector, Weather Bureau.*

SAN FRANCISCO FORECAST DISTRICT.

The month as a whole has been an uneventful one. Cooler weather than usual prevailed throughout California, permitting fruit to ripen slowly. From July 12 to 17 and again from the 20th to 24th generous rains and frequent thunderstorms occurred from the Valley of the Colorado eastward. Warnings of warmer weather with high north winds were issued for northern California on July 2, and were verified.—*A. G. McAdie, Professor of Meteorology.*

PORTLAND, OREG., FORECAST DISTRICT.

The first decade of the month in this district was unsettled and showery, and the month, as a whole, averaged from 1° to 3° cooler than usual. A light frost occurred in southwestern Idaho on the morning of the 3d, for which warnings were issued twenty-four hours in advance.

The Columbia River slowly fell during the entire month, and at Portland, Oreg., the river passed below the danger mark during the afternoon of the 14th. It was forty-one days above danger line, during fifteen days of which time it was rising; on two days it was stationary, and during the remainder of the period it was falling.—*E. A. Beals, District Forecaster.*

DENVER FORECAST DISTRICT.

No special warnings were issued. The feature of the month was the exceptionally cool weather that prevailed following the passage of a low barometer area that developed in the middle Rocky Mountain region during the afternoon of July 1. During the 3d the fall in temperature was sharp, with a general and killing frost in high agriculture districts, and light local frosts at moderate elevations on the 3d and 4th. Cooler weather was forecast for almost the entire district on the mornings of the 2d and 3d.—*F. H. Brandenburg, District Forecaster.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	41	124	3, a. m.	47	122	525	2.0	262	10.9
II	3, p. m.	49	86	6, a. m.	32	65	1,675	2.5	670	28.0
III	3, p. m.	47	112	10, a. m.	27	80	3,800	6.5	585	24.4
IV	6, p. m.	41	124	8, a. m.	45	100	1,375	1.5	917	38.2
V	8, p. m.	45	123	18, a. m.	32	65	4,150	9.5	437	18.2
VI	16, a. m.	53	121	21, p. m.	37	81	3,600	5.5	654	27.2
VII	22, a. m.	47	92	25, p. m.	38	80	1,400	3.5	400	16.7
VIII	24, p. m.	53	105	28, a. m.	39	75	2,000	3.5	571	23.8
IX	28, a. m.	48	117	4, a. m.*	45	64	3,575	7.0	511	21.3
Sums							22,100	41.5	5,007	208.7
Mean of 9 paths							2,456		556	23.2
Mean of 41.5 days									532	22.2
Low areas.										
I	29, p. m.†	38	105	2, p. m.	46	60	2,475	3.0	825	34.4
II	30, p. m.†	50	120	3, p. m.	50	100	2,225	3.0	742	30.9
III	2, p. m.	35	112	6, a. m.	44	70	2,550	3.5	728	30.3
IV	4, p. m.	44	116	8, a. m.	48	89	1,750	3.5	500	20.8
V	15, a. m.	35	112	19, a. m.	41	70	2,500	4.0	625	26.0
VI	21, a. m.	48	89	24, a. m.	46	60	1,700	3.0	567	23.6
VII	25, p. m.	44	116	30, p. m.	48	68	2,750	5.0	550	22.9
Sums							15,950	25.0	4,537	188.9
Mean of 7 paths							2,278		648	27.0
Mean of 25.0 days									638	26.6

* August. † June.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*George E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

Nothing of special interest transpired in the various river districts during the month. As a rule the stages were lower than during the preceding month. In the interior districts, however, they were higher than the usual summer stages, as a result both of the substantial rainfall and of the fact that the flood waters of May and June had not entirely passed out.

In the upper Red River there was a period of comparatively high water from the 4th to the 7th, with danger line stages at Arthur City, Tex., and Fulton, Ark. Warnings that were telegraphed on the morning of the 4th to all available points within the State of Arkansas were well verified by the subsequent events. Some losses to crops were reported, amounting to perhaps $15,000 or $20,000, while the value of property saved by removal or protection was, according to advices received, about $200,000.

Heavy local showers over Texas during the first few days of the month also caused a sharp rise in the Trinity River. At Dallas, Tex., the water rose from 7.9 feet on the 2d to 32.7 feet on the 6th, the latter stage being 7.7 feet above the danger line. At points below the rise was not so marked. Warnings were distributed on the morning of the 4th, but four days after the establishment of the service on Trinity River. This new service is a part of the extensive additions that were made to the Texas River and Flood Service on July 1, 1903. Heretofore, service had been maintained only on the Brazos River, but on July 1 new river stations were established as follows: On the Sabine River, at Logansport, La., and Orange, Tex.; on the Neches River, at Rockland and Beaumont, Tex.; on the Trinity River, at Dallas, Riverside, and Liberty, Tex., and on the Colorado River, at Ballinger, Austin, and Colum-

bus, Tex. An additional station was also located on the Brazos River, at Hempstead, Tex.

Traffic was uninterrupted on the navigable rivers, except the upper Tennessee, where low water necessitated a suspension of navigation on the 25th.

The highest and lowest water, mean stage, and monthly range at 175 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, District Forecaster.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during July are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—While the rainfall was deficient over most of the State enough was received to favor growth and final cultivation of crops. Cotton, though comparatively small, made good growth and was fruiting well; bolls were maturing and some opening in southern counties at close of the month. Early and late corn were in good condition, promising an unusually good yield. Minor crops did well and much hay was saved in excellent condition. Fodder pulling was in general progress.—*Thomas Crawford.*

Arizona.—The weather during July was moderately warm, with considerable cloudiness and frequent showers from the middle of the first decade to the middle of the third decade. The dry weather during the latter half of June and the early part of July began to have an injurious effect upon vegetation, but the showers later in July revived crops and ranges so that they were generally in good condition throughout the rest of the month.—*M. E. Blystone.*

Arkansas.—The temperature was seasonal, with a slight excess of rainfall. Cotton, while small, made rapid growth, and the bulk of the crop was laid by in fair to good condition. A good crop of early corn was assured; the late was promising, but in some limited sections it suffered from lack of moisture. The thrashing of wheat and oats was well advanced, the yield being light and quality good. Considerable hay of excellent grade was secured. Gardens, pastures, and forage crops were in fine condition; no improvement in apples and peaches.—*Edward B. Richards.*

California.—Extremely hot weather on the 2d and 3d caused but little damage to deciduous fruits, and was followed by abnormally cool weather most of the month. High winds slightly damaged grain, considerable of which, and also of pasturage and timber were destroyed by fire. Grain harvest was nearly completed in some sections at close of the month. Wheat, oats, and barley were fair crops in the central and northern districts and unusually heavy in southern California. Deciduous fruits were yielding heavily.—*Alexander G. McAdie.*

Colorado.—The weather conditions were favorable. While precipitation was somewhat below normal, irrigation water was generally sufficient. The harvest of winter wheat and rye advanced favorably, and much spring wheat, oats, and barley was ready to harvest at the close of the month. Corn, potatoes, beets, gardens, and fruits did well. Much native hay was cut and stacked in prime condition, and cutting of the second crop of alfalfa was well under way during the last decade. The ranges afforded excellent pasturage.—*F. H. Brandenburg.*

Florida.—The month was slightly cooler than the normal, with an excess of more than an inch of rainfall, the latter being fairly well distributed over northern, western, and central counties and over the western portion of the southern district. The rainfall, both in amount and distribution, was generally unsatisfactory in Atlantic coast counties. Cotton made fair progress, though several weeks late; it fruited slowly, but made good stalk. The corn crop promised to be the best for several years; it was laid by mostly during last week of month. Cane, cassava, peas, and minor crops did well. Citrus fruits made good progress, though rainfall was less than the requirements. Many pineapple slips were set out.—*A. J. Mitchell.*

Georgia.—Rainfall well distributed, but below the average. General conditions most favorable to all farming interests and crops improved materially during the month. Cotton made rapid growth and at the close of the month was healthy and taking on squares and blooms in the northern section, and fruiting in middle and southern divisions, comparatively little shedding being reported. Cane, peas, potatoes, and minor crops made satisfactory progress, the indications being favorable for large yields.—*J. B. Marbury.*

Idaho.—Weather generally favorable for farming operations, with abundant water for irrigation in most canals until near close of the month, when shortage of water began to cause anxiety in localities. Fruit advanced rapidly, early varieties being abundant and in market. The yield of hay was good. Sugar beets made satisfactory growth.—*S. M. Blandford.*

Illinois.—The first half of the month was warm and vegetation was greatly stimulated; the latter part was mostly too cool for normal growth. The rainfall was not well distributed, and periods of drought were experienced. Corn made fair advance, but at the end of the month it was estimated to be from two to three weeks backward, and very uneven. A large crop of hay of fine quality was secured. The harvesting of oats was progressing and some thrashing done, the yield being generally below the average. The outlook for apples was not promising.—*Wm. G. Burns.*

Indiana.—In south section cutting of wheat and oats was practically completed during first half of July, and the bulk of these crops was thrashed before close of month, the yields being fair to very light; in central and north sections cutting and thrashing continued under favorable conditions, with better but not satisfying results, some fields yielding fair to good and others about half crop. An unusually heavy crop of hay was secured, mostly in excellent condition. Corn made normal growth, but was very uneven, much being from one to three weeks late.—*W. T. Blythe.*

Iowa.—The month was slightly cooler than usual, with sudden alternations in temperature. Rainfall was excessive in northern section and deficient in southern. General conditions were quite favorable for haymaking and harvesting wheat, oats, rye, and barley. A large crop of hay was secured in best condition. Grain crops were affected by blight and rust and yields lighter than usual, but grain in better condition than last year. Corn late, but made fairly good progress. Potatoes and minor crops did well.—*John R. Sage.*

Kansas.—Harvesting of wheat, oats, and barley finished, wheat being much better in the west than in the east; oat yield was lighter than expected, but the yield of barley was good. Early corn tasseled, silked, and eared well, and late corn made good growth. Second crop of alfalfa stacked, third crop doing well; prairie hay good. Early apples ripe and abundant in south.—*T. B. Jennings.*

Kentucky.—Rainfall was unevenly distributed. Drought damaged crops considerably in eastern and some central counties. Cool weather from the 12th to 22d retarded growth of corn and tobacco. General rains about the close of the month greatly improved crops. Corn and tobacco in the western and southern counties were very promising, but they were backward in northern and eastern counties. The yield of wheat was very poor; that of oats and hay was good.—*S. P. Gresham.*

Louisiana.—Warm, showery weather during the first half of the month caused cotton to grow rapidly, but the showers were so frequent as to prevent cultivation, and the crop suffered some injury from grass, especially on lowland. More favorable conditions prevailed during the latter half of the month and the bulk of the cotton crop was laid by, generally free from weeds and grass, but from two to four weeks late. Sugar cane made vigorous and healthy growth. Rice was promising and harvest commenced in a few parishes. Conditions were generally favorable for the corn crop.—*I. M. Cline.*

Maryland and Delaware.—Prevailing wet weather interfered somewhat with harvest and several cool spells checked growth, especially of corn. Wheat gave light yields of inferior grade, and rye, barley, and oats were generally short. Timothy improved decidedly, however, and gave fair to good yields. Cornfields were grassy and the crop rather backward. Tobacco was small but healthy and topping had begun. Apples continued promising, and truck, with the exception of melons and cantaloupes, yielded satisfactorily.—*Oliver L. Fassig.*

Michigan.—The month was generally favorable for crop growth and harvest work, but the last half was too cool for best growth of corn. Hay, wheat, rye, and barley were generally well secured. Sugar beets, oats, peas, potatoes and beans made good progress and apple prospects continued promising.—*C. F. Schneider.*

Minnesota.—Crops in north revived by rains of 1st to 4th and locally benefited by rains of 9th; rains of 27th were too late for early crops; elsewhere too much rain flooded lowlands and caused rank growth of spring wheat, oats, and barley, with lodging and tendency to rust. Local wind, rain, and hail storms on the 7th, 9th, 16th, 20th, and 27th, with aggregate loss exceeding a million dollars. About the 15th rye and early barley were being cut and early oats and winter wheat ripening. On the 31st all the rye and most of the barley and winter wheat were cut, while spring wheat and early flax were ripening rapidly in south half of the State. Corn growth was retarded by wet and cool soil. The hay crop was light in north and abundant in south. The flax crop was good in many places.—*T. S. Outram.*

Mississippi.—Cotton generally made a healthy and rapid growth and at the close of the month was blooming and fruiting nicely, although late and smaller than usual. The corn crop was the best in years; the early matured well and the late was very promising. Sugar cane, sorghum, peas, rice, and potatoes made a splendid growth. The hay crop was excellent and pastures good. Peaches were fair in south, but poor in north. Apples did well.—*W. S. Belden.*

Missouri.—The temperature was generally favorable for growing crops, but in most sections the rainfall was insufficient. Corn, which was very uneven and generally late, suffered to some extent from lack of moisture during the latter part of the month, and the condition of the crop, as a whole, was much below the average. Other crops were also injured by drought in localities. The month was very favorable for harvesting and haying, however, and wheat, oats, and hay were secured in good condition.—*A. E. Hackett.*

Montana.—The month was wet and cool, and the maturing of winter grain was retarded somewhat, but the conditions were fairly favorable for spring grain. Haying was general at the end of the month, but was frequently interrupted by showers, a yield below the average being indicated. The first crop of alfalfa was secured and was fairly good; the second crop advanced rapidly and was very promising. The potato crop was unusually good. Ranges improved.—*Montroe W. Hayes.*

Nebraska.—A very favorable month for harvesting in spite of the excessive rainfall, and most winter wheat and oats in the southern part of the State were secured in good condition; thrashing and stacking progressed well; the yield of winter wheat was less than expected, and oats were rather light, both in yield and weight. Corn did not grow sufficiently fast to regain the ground lost early in the spring by unfavorable conditions. Early corn was in tassel by the last decade of the month, but much of the crop was from two to three weeks later than usual.—*G. A. Loveland.*

Nevada.—The month on the whole was unusually cool and remarkably dry, being drier than any July in the last fifteen years. Irrigation water was quite plentiful throughout the month, and crops of all kinds made rapid and satisfactory progress. A heavy first crop of alfalfa was cut and saved in prime condition, and a fine second crop assured. The grain crops never looked better at this time of the year, and fruit prospects were the best in many years.—*J. H. Smith.*

New England.—The first part of the month was warm, and the weather generally favorable to crops; the latter part was cool, with much cloudiness, and frosts occurred in some northern sections. While the precipitation was deficient it was well distributed through the period and over the territory. The season was from ten days to a fortnight behind the average, and crops correspondingly retarded.—*J. W. Smith.*

New Jersey.—Nights were generally cool, retarding the growth of vine truck and corn, especially watermelons, cantaloupes, cucumbers, and lima beans. The late planted corn made poor progress, the fields being very uneven. Frequent showers, very heavy in places, prevented cultivation in many localities, the ground being too wet to work. Harvesting of grain and hay proceeded slowly.—*Edward W. McGann.*

New Mexico.—Month was characterized by the absence of the usual rains. However, owing to the unusual and heavy rains in June crops did not suffer much excepting toward close of month. Stock was in excellent condition, but ranges were getting dry toward end of month.—*R. M. Hardinge.*

New York.—First half of month was very favorable, but frequent rains and low temperatures during latter half were very detrimental. By end of month hay had improved sufficiently to warrant an estimate of full crop, and wheat and rye were mostly cut and saved, the yield being good. Oats and barley were promising, but corn was decidedly backward. The prospects for beans and hops on the whole were favorable. Tobacco, buckwheat, and potatoes, were vigorous. In the Chautauqua grape belt and the Keuka section a light yield of grapes was indicated. Apples varied widely in different sections, the crop being less than the average generally, and other fruit was light. Pastures were very good.—*R. G. Allen.*

North Carolina.—The weather was very favorable for crops and for all kinds of farm work. The rainfall was sufficient, except during the last decade, when drought began to cause considerable injury to upland corn. Cotton improved steadily; blooms appeared the first week of July, and by the close plants were blooming freely everywhere and fruiting well. Corn did well, late corn being especially promising. Tobacco began to ripen and curing advanced rapidly, but with yield inferior to last year's in weight and quality. Sweet potatoes, rice, peanuts, and peas did well. Only in limited sections did fruit give an average yield. Melons were late and inferior. A good crop of hay was saved.—*C. F. von Herrmann.*

North Dakota.—Weather conditions were generally unfavorable for crops. While some sections had an average amount of rain, the greater part of the State did not receive enough and crops suffered severely. In many sections early grain was so damaged that some was plowed up, and but few crops, except flax, were in a promising condition at the close of the month. Light frosts during the last week did slight damage to tender vegetation.—*B. H. Bronson.*

Ohio.—The month was slightly cooler than the normal. The precipitation was in excess in the north, but deficient in other sections, particularly in the southwest. The number of cloudy days was very small. At the close of the month crops were affected by drought in central counties. Grain yield was disappointing, the hay crop large, corn very poor. Other field crops and apples fair and peaches small.—*J. Warren Smith.*

Oklahoma and Indian Territories.—Early corn made and late filling well where rains occurred. Cotton made good growth, formed squares, bloomed, and fruited well, and was in a fair to good condition. Wheat and oat harvest completed. Cane, kaffir and broom corn, castor beans, June corn, and millet in good condition. Barley, alfalfa, millet, and hay secured, good yields. Early potatoes secured, fair to good yields; late potatoes planted. Early fruit light to fair yields; late fruit promising.—*C. M. Strong.*

Oregon.—The month was cooler than usual. Scattered showers during the first decade were beneficial to all crops. At the close of the month the fall wheat harvest was well advanced and the cutting of spring wheat had begun; the yields were below the average, but the quality was excellent. Potatoes, gardens, and fruit of all kinds made good progress. Hops continued backward, but were otherwise promising. An average hay crop was secured in excellent condition.—*Edward A. Beals.*

Pennsylvania.—The month, as a whole, was both cool and wet—conditions generally unfavorable to haying, harvesting, and maturing of growing crops. Continued low temperatures and lack of sunshine materially retarded the development of tobacco and late corn and potatoes. Frequent showers prevented the cultivation of the last-named crops and damaged much wheat, rye, and hay after cutting, but the rains brought about such a rapid improvement in grasses that what had promised to be a light hay crop was practically up to the average in most sections.—*T. F. Townsend.*

Porto Rico.—Weather conditions were generally favorable and all crops did well. Cane improved materially in color and was in good condition. Coffee matured well. Some land was prepared for tobacco. A good corn crop was harvested, but bean crop was generally light. Rice was promising. Land was prepared for the August planting of small crops and gran cultura. Pasturage was good and abundant.—*E. C. Thompson.*

South Carolina.—The even warmth was favorable to crops during the greater part of the month, but excessive heat during the last week, in connection with unusually low humidity and general absence of rain, was detrimental to all vegetation. These conditions hurt corn severely where in the silking stage and also caused "fireing." Cotton suffered on sandy lands. Tobacco harvest progressed favorably. Minor crops did fairly well.—*J. W. Bauer.*

South Dakota.—Crops made favorable progress. By the 31st spring wheat harvest was general, barley harvest was closing, and oat and spelt cutting were far advanced, with wheat indicating variable, and rye, barley, oats, and spelt good yields; some barley was discolored. Frequent rains somewhat retarded harvesting and haying and lodged considerable grain, and rust affected some wheat and oats. Corn, flax, and potatoes made thrifty advance. Pastures, hay grass, and late small grains were improved and early wheat and oats matured fast.—*S. W. Glenn.*

Tennessee.—The rainfall came in scattered showers, but nearly all sections received sufficient to keep crops growing well. The temperature conditions were favorable. The hay crop was fine, corn very promising, and cotton late, but the latter grew rapidly and began to fruit. Tobacco was mostly topped and in good condition. Gardens and grapes were very promising and a fair crop of apples was expected; peaches were scarce and inferior. The wheat crop was short, but the yield of oats was fairly good.—*H. C. Bate.*

Texas.—Some damage was done by drought in the western portion and in the western counties of the north portion, but east of the one hundredth meridian there was generally an excess of rainfall. Temperature conditions were generally favorable for crop development. Cotton made rapid growth, but was between two and four weeks late in the middle and northern portions at the close of the month; during the latter half the plants fruited nicely and many fields were laid by in good condition. Bolls began to open in the southwest portion during the second decade; boll weevil did considerable damage during the first week, but apparently little damage after that. Conditions were generally ideal for corn assuring a large yield. Thrashing progressed rapidly, and wheat, barley, rye, and fall oats turned out well; the yield of spring oats was light. Rice and sugar cane did exceptionally well.—*L. H. Murdoch.*

Utah.—The weather was warm and dry, with an abundance of sunshine. Scattered thunderstorms, some destructive in character, occurred at different periods, but the precipitation was generally light and insufficient. The long continued dryness seriously affected the supply of irrigation water, and reservoirs and ditches were becoming very low; where properly irrigated crops made rapid growth, but on dry farms they suffered serious deterioration from lack of moisture. Fall wheat, barley, and rye were being harvested. Spring wheat and oats were heading rapidly. The second crop of alfalfa was being gathered, with yields below the average. Sugar beets were in good condition where properly irrigated. Early planted corn was in silk and tassel. Fruit was generally good, excepting apples, which were inferior in quality. Ranges were drying up.—*R. J. Hyatt.*

Virginia.—Weather conditions were generally favorable for crop growth. The temperature was seasonable, and the rainfall sufficient and well distributed. Harvest of winter wheat and oats was finished early in the month and spring oats secured by the latter part. Corn made

excellent progress, while tobacco began to "button" and considerable topping was done. Haying was carried on under favorable circumstances and a generally good crop secured. Apples were promising at the close of the month.—*Edward A. Evans.*

Washington.—Unseasonably cool weather predominated, with heavy rainfall during the first week, but, on the whole, it was favorable for the staple crops. Haying was delayed until 7th, and there was some slight damage, but a good crop was secured. Fine weather for maturing and harvesting winter wheat, and for the growth and filling of spring wheat and oats. Barley and winter wheat yields were below the average in general, although there were some good fields.—*G. N. Salisbury.*

West Virginia.—There was a marked improvement in corn during the hot weather of the first two weeks. Wheat and rye harvest was practically completed during the third week. At the close of the month haying was well advanced, the crop being rather poor. Corn was making very good growth and mostly laid by, but very uneven. Both Irish and sweet potatoes were promising. There were practically no peaches, pears, or plums, and only a few apples, except in panhandle and some southern counties, but grapes were promising.—*E. C. Vose.*

Wisconsin.—Month was cooler than usual, except along southern and eastern borders, with decidedly cool periods on the 15th and 31st, freezing temperatures being reported from a few stations in the northern section on these dates. The precipitation was heaviest in the northwestern counties, amounting to nearly 10 inches at some places. There was some damage to hay and other crops by the heavy and frequent rains, but with the exception of corn, crops generally were in satisfactory condition at the end of the month, corn being vigorous and healthy but backward.—*W. M. Wilson.*

Wyoming.—The first week was unusually cold and damaging frosts occurred in some agricultural sections. Warm weather prevailed in the middle and last decades, but the temperature excess was slight. All crops were late. A good first crop of alfalfa was secured, and the harvest of native hay was commenced by close of month.—*W. S. Palmer.*

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course this number is much smaller than the total number of stations.

Summary of temperature and precipitation by sections, July, 1903.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.					Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	80.0	−0.2	Evergreen	102	1	Florence	54	14	3.98	−1.04	Daphne	7.22	Haleysville	1.25
			Lock No. 4	102	24	Valley Head	54	15						
Arizona	82.9	−1.1	Mohawk Summit	117	5	Fort Defiance	33	4	1.17	−0.70	Fort Huachua	3.76	Aztec	T.
Arkansas	79.6	−0.6	Oregon	105	7	Dodd City	53	13	3.90	+0.10	Prescott	8.27	Silver Springs	1.31
California	71.2	−3.8	Imperial	121	12	Bodie	15	19	T.	−0.03	Motague	0.25	Many stations	0.00
Colorado	67.6	+2.5	Blaine	111	2, 16	Antelope Springs	23	4	1.57	−0.61	Wray	5.16	Rockyford	0.42
Florida	81.1	−0.6	Middleburg	105	28	5 stations	60	.....	6.46	−1.03	Pensacola	4.39	Fernandina	1.17
Georgia	80.0	0	Eastman	103	23	4 stations	52	.....	4.00	−1.95	Dudley	9.34	Hephzibah	1.12
Idaho	63.3	.....	Lewiston	105	22	Chesterfield	27	3	0.86	.....	Dickey	2.50	Albion	T.
						Silver City	27	14					Blackfoot	
Illinois	75.7	−0.4	Benton	102	25	Kishwaukee	40	30	3.90	+0.15	Zion	9.45	Centralia	0.92
			Olney	102	8									
Indiana	74.8	−0.8	Crawfordsville	101	10	Auburn	45	15	3.44	+0.09	Huntington	7.39	Marengo	0.82
Iowa	72.9	−1.5	Thurman	100	9	Chester	40	31	4.83	+0.91	Elkader	12.72	Belknap	0.94
			Sigourney	100	27									
Kansas	78.3	−0.3	Forsha	110	22	3 stations	44	4	3.17	−0.25	Moran	10.42	Englewood	T.
Kentucky	77.5	+0.1	Owenton	104	9	Loretto	49	14	3.53	−0.69	Manchester	6.41	Bardstown	1.06
Louisiana	80.8	−0.8	Libertyhill	103	22	Mansfield	54	14	6.14	+0.49	Lafayette	11.00	Franklin	2.29
			Monroe	103	6									
Maryland and Delaware	74.6	−0.9	Great Falls, Md	100	2, 10, 30	Deer Park, Md	36	5, 20	5.48	+1.49	Chewsville, Md	8.85	Dist. Res., D. C.	3.56
			Seaford, Del	100	11									
Michigan	67.9	−1.1	Owosso	99	3	Baraga and Wetmore	20	1	3.97	+0.60	Iron River	9.50	Lake City	0.17
Minnesota	67.2	−2.6	New Ulm	96	27	Leech Lake Dam	26	11	5.11	+1.50	Milaca	11.40	Angus	0.87
Mississippi	80.7	−0.2	Aberdeen	103	6	Yazoo City	51	14	4.69	−0.53	McNeill	11.05	Tupelo	0.58
			Okolona	103	28									
Missouri	77.4	+0.2	Princeton	102	10	Conception and Maryville.	51	31	3.22	−1.06	Willow Springs	8.56	Rolla	0.78
Montana	64.4	−3.1	Miles City	104	22	Wolsey	28	4	2.81	+1.21	St. Peter	5.89	Butte	0.65
Nebraska	73.0	−1.8	Beaver City	103	9	Kimball	41	3	4.94	+1.42	Genoa	9.90	Auburn	1.01
Nevada	65.4	−4.8	Rioville	111	28	Potts	26	7	0.01	−0.43	Fenelon	0.30	31 stations	0.00
New England*	68.1	−0.7	North Bridgeton, Me	100	9	Orono, Me	34	27	3.66	−1.01	Morrisville, Vt	7.16	Nantucket, Mass	1.81
New Jersey	73.3	−0.9	Bridgeton	100	2	Charlotteburg	38	28	5.51	+0.32	Atlantic City	10.14	Ringwood	3.08
New Mexico	73.4	+0.1	Alamogordo	109	8	Winsors	26	4	0.85	−1.90	Winsors	3.75	Engle	T.
New York	67.7	−1.3	Oyster Bay	98	9	Axton	31	28	4.20	+0.30	Number Four	10.03	Southampton	1.66
			Primrose	98	10									
North Carolina	78.1	+0.4	Moncure	102	26	Franklin (near)	41	14	3.79	−1.71	Whiteville	8.99	Henrietta	0.21
North Dakota	66.7	−1.3	Wishek	109	23	Mayville	26	31	2.13	−0.50	Forman	5.72	Minot	T.
Ohio	72.9	−0.9	Warsaw	104	25	5 stations	42	16	3.67	−0.08	Hudson	7.70	Bloomingburg	1.18
						Wooster	42	23						
Oklahoma and Indian Territories.	81.2	+0.5	Ural, Okla	116	24	Kenton, Okla	44	4	2.55	−1.12	Durant, Ind. T.	10.89	Fort Sill, Okla	0.00
Oregon	63.5	−2.2	Umatilla	107	20	Deschutes	28	14	0.52	0.00	Bull Run	1.93	4 stations	0.00
Pennsylvania	71.2	−0.9	Mauch Chunk	98	9	Dushore	35	28	5.36	+0.72	Pottsville	8.81	Harrisburg	1.76
			Hamburg	98	10									
Porto Rico	79.3	.....	Cayey	99	18	Cidra	50	23	7.44	.....	La Carmelita	15.20	Barros	2.60
South Carolina	80.4	+0.3	Florence, Gaffney	103	27	Walhalla	45	16	3.59	−1.99	Gillisonville	8.54	Winthrop College	0.95
South Dakota	70.5	−2.0	4 stations	105	6, 24, 27	3 stations	38	29–31	4.19	+1.55	Sisseton Agency	8.35	Leola	1.29
Tennessee	77.8	+0.2	Jackson	102	22	Silver Lake	44	16	3.80	−0.65	Bristol	7.92	Pope	0.97
Texas	81.4	−1.9	College Station	110	24	McKinney	51	2	5.81	+3.41	Marlin	17.72	Comanche	T.
Utah	71.0	−1.6	Loa	110	20	Woodruff	27	4	0.52	+0.03	Soldier Summit	2.00	4 stations	0.00
Virginia	75.5	−1.0	Newport News	101	30	Burkes Garden	38	6	3.87	−0.72	Callaville	7.95	Barboursville	1.11
Washington	63.2	−2.4	Zindel	109	22	Wilbur	30	14	1.01	+0.12	Ilwaco	3.58	Pasco	0.00
West Virginia	75.5	−1.1	Charleston	100	10	Travelers Repose	37	16	3.74	−1.19	Terra Alta	8.30	Huntington	1.82
			Webster Springs	100	28									
Wisconsin	69.1	−1.1	Prairie du Chien	99	29	Tomahawk	31	31	6.13	+2.20	Butternut	9.88	Oconto	2.14
Wyoming	64.5	−1.6	Basin	107	26	South Pass City	18	3	1.42	+0.16	Thermopolis	5.81	Lander	0.21

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

SPECIAL CONTRIBUTIONS.

NOTE UPON ECONOMICAL SHAPES FOR CUTTING ENVELOPES OF BALLOONS.

By C. F. MARVIN, Professor of Meteorology, dated July 31, 1903.

Small balloons of rubber, silk, or paper ranging from 2 or 3 to 15 feet or more in diameter are frequently employed in connection with meteorological investigations now being conducted in the upper air, and it becomes a matter of importance to determine how the envelopes of such balloons can be formed in the most practical and economical manner. Suggestions made to me some months since by Professor Abbe, calling my attention to the greater economy afforded by certain unusual forms, has led me to examine the geometric principles involved in this problem. The results are of not a little interest to the geometer and moreover have a decided practical value in connection with the art of balloon construction, whether large or small.

Some of the conditions which are generally sought to be realized in balloon construction for serious purposes may be stated as follows:

(1) Minimum weight of the envelope consistent with strength and imperviousness to gases, etc.

(2) Maximum volume inclosed within minimum superficial envelope.

(3) Most equable distribution of the tensile stress to which all parts of the envelope are as a rule subjected.

(4) Facility and simplicity in computing and laying out an envelope of a given size, and ease in uniting the parts by cementing, sewing, or otherwise.

The selection of the material for the envelope practically decides the case under (1).

Any other form than a sphere involves a larger amount of surface and therefore greater weight in the envelope for the same volume inclosed.

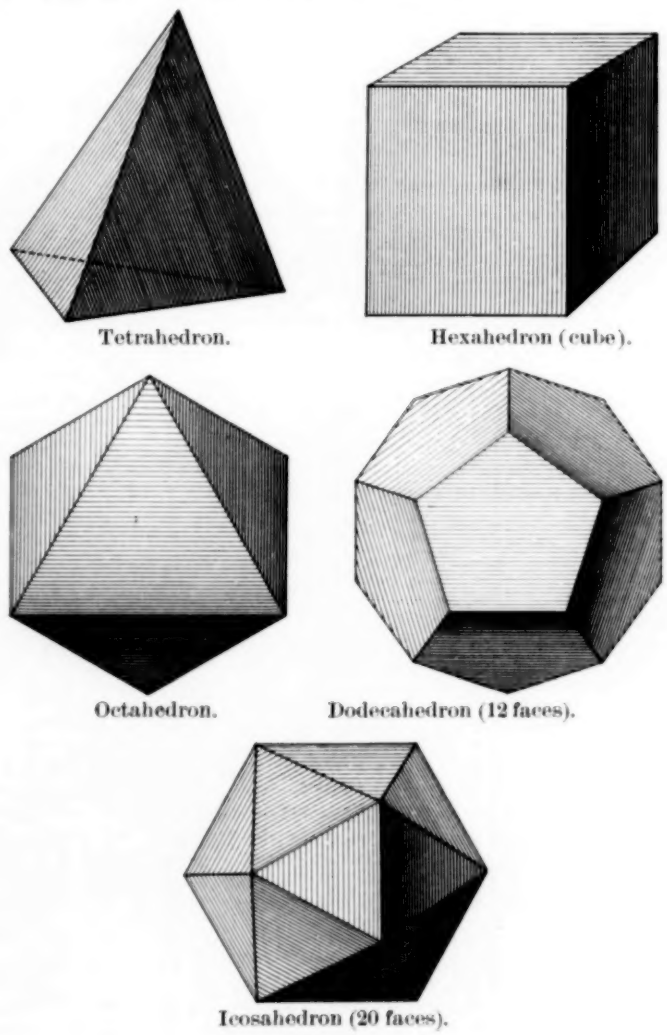
The most equable distribution of superficial stresses is also realized in a sphere, or, at least, in a shape with hemispherical top, as the stress is greatest in this region. The spherical form therefore best satisfies the conditions under both (2) and (3).

The customary methods of forming the envelope of a balloon of approximately spherical shape consist in cutting the fabric of the envelope into a sufficient number of relatively narrow so-called *gores* of the proper form, and cementing or sewing these together along the edges. The seams in this case form meridional lines over the sphere, as indicated in fig. 1.

FIG. 1.

Gores of this character can not be cut without a very considerable waste, which is a matter of serious moment in the case of such valuable material as silk, rubber, etc. The length of a gore on a sphere of radius R will be $l = \pi R$, and if there are n gores the area of each, exclusive of overlap at seams, will be $1/n$th that of the spherical surface $= \frac{4\pi R^2}{n}$. So, likewise, the the width of the material from which the gores are cut must be $\frac{2\pi R}{n}$. Hence, the area of a band sufficient to form a gore must be $\frac{2\pi^2 R^2}{n}$ and the percentage of the band usefully employed $= \frac{2}{\pi} = 64$ per cent. In other words the material wasted in cutting gores amounts to $\frac{36}{64} = 57$ per cent of the surface of the sphere formed. This is obviously a very wasteful plan of construction, and while a small saving can be effected by overlapping the narrow points of the gores, yet this is only a partial remedy and not so satisfactory as other methods we shall describe presently.

It is interesting at this point to inquire into the suitability for this purpose of the *regular* or other polyhedral figures geometry has to offer. As is well known there are only five *regular* solids. These are shown in fig. 2.



Tetrahedron. Hexahedron (cube).

Octahedron. Dodecahedron (12 faces).

Icosahedron (20 faces).

FIG. 2.

The faces of these forms can be cut out with great economy, except perhaps in the case of the pentagon, but it is obvious that such figures as the cube, or even the octahedron, with eight sides, are unsuitable as a gas envelope, principally be-

cause of the unequal stresses over the different portions of the envelope. In fact, even the dodecahedron and the 20-sided solids are almost equally unavailable, owing to their relatively wide deviation from a sphere or figure of revolution.

Passing to the infinite number of possible *irregular* solids we may simply say that these, if not otherwise objectionable and unsuited, so far fail to satisfy condition (4) above as to be unavailable.

We find therefore that those methods of forming a gas envelope which aim to approximate more or less closely to a sphere prove to yield by far the most satisfactory results.

Zonal subdivision.—The peculiar style of spherical covering familiarly seen on "baseballs" can be formed with very little waste of material, as will be seen from the following description of a method of laying out a spherical envelope of this character. For this purpose four points are imagined to be located on the surface of the desired sphere so as to constitute the polar extremities of two axes at right angles to each other. One pair of poles is shown at p_1 and p_2, fig. 3.

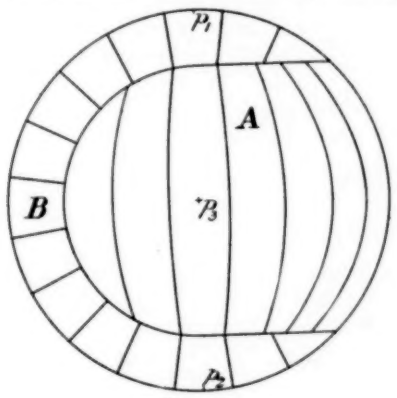


FIG. 3.

The other pair both appear projected at p_3. Now 4 semicircles, at latitude 45°, can be so drawn from these polar points and connected at points of tangency as to divide the spherical surface into two exactly equal and similar incomplete zonal bands or fields, *A B*, which interengage each other in the manner shown in fig. 3.

The fields may now be subdivided into any necessary number of meridional gores in the manner indicated.

Fifteen gores in each zonal field is regarded as a sufficient subdivision for a sphere about 10 feet in diameter, and one such subdivided zone is shown developed in fig. 4.

The distinctive advantage of this manner of laying out the envelope is found in the fact that with a few exceptions the gores are exactly alike throughout and have a symmetrical and nearly rectangular outline.

Fig. 5 shows how the unsymmetrical gores can be cut out from a band of material with minimum waste.

The coefficient of economy in this case can be computed in the following manner. With 15 gores to the zone the material from which the gores are cut must, for a sphere of radius R, have a width given by the equation:

$$w = \frac{\pi R}{10}.$$

The length of the long gore must be

$$l = \frac{\pi R}{2}.$$

The graphical construction in figs. 4 and 5, when made to scale, suffice to easily determine the relative amounts of material in the short gores; that is to say, upon measurement the band in fig. 5 will be found to aggregate 3.2 times the length of a normal gore. Consequently, the area of the material required to form the whole zonal field is $14.2\,\frac{\pi^2 R^2}{20}$. The spherical area of the zone is $2\pi R^2$; hence, the coefficient expressing the economy is $\frac{40}{14.2\pi} = 89$ per cent.

In this computation I have not included overlaps, which are necessary at the seams, for the reason that while this material is not directly used to form the spherical surface, yet it is necessary and useful and ought not to be computed with the waste.

From the above it is seen that only 11 per cent of the fabric is necessarily wasted, or that the waste amounts to 12 per cent of the spherical surface. This result is in marked contrast to the meridional gore construction, in which, as we have seen, 36 per cent of the material or 57 per cent of the spherical surface is wasted.

One unique feature of the zonal construction is that the zones unite without the formation of any congruent angles. The bounding lines of the zones unite in a continuous closed seam. This may not be so convenient, perhaps, for the insertion of an outlet pipe or neck for the envelope, but is, nevertheless, not of serious consequence.

Quadratic subdivision.—Another equally economical and simple plan of subdivision of the surface, and one recently employed in the construction of a large balloon for the Aeronautical Society of Munich, was described, with other interesting forms, by Dr. Finsterwalder in the Illustrirte Aeronautische Mittheilungen, October, 1902, p. 155.

The development of this subdivision and its geometric characteristics will be understood from what follows:

A cube is imagined to be inscribed within the desired sphere, and the points at which its corners touch the surface are connected by great circles; in other words, the edges of the cube

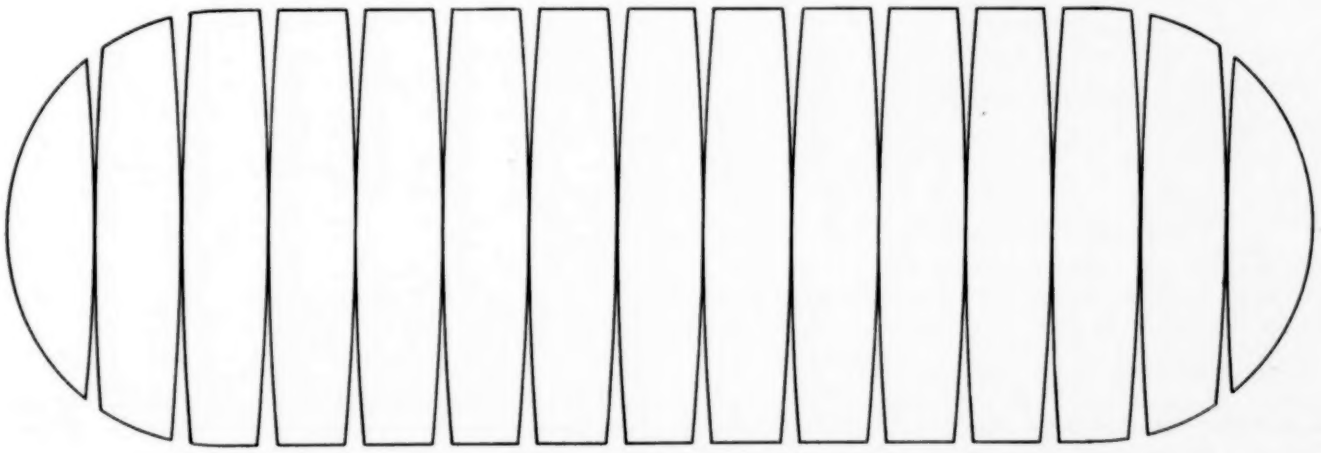


FIG. 4.

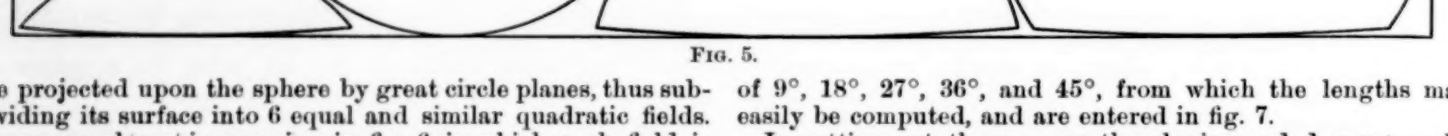


FIG. 5.

are projected upon the sphere by great circle planes, thus subdividing its surface into 6 equal and similar quadratic fields. These are shown in one view in fig. 6, in which each field is

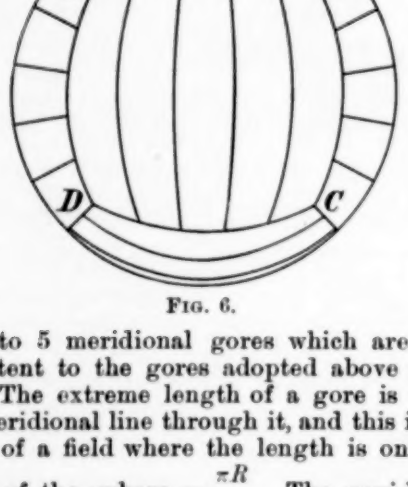


FIG. 6.

subdivided into 5 meridional gores which are very similar in general extent to the gores adopted above for the zonal subdivision. The extreme length of a gore is the length of the longest meridional line through it, and this is a maximum in the middle of a field where the length is one-quarter the circumference of the sphere $= \frac{\pi R}{2}$. The semi-length l of a meridian, in degrees intercepted between the boundaries of a field at any point having a longitude, a, measured from the central meridian, is given by the equation—

$$\tan l = \cos a. \qquad (1)$$

If n is the number of gores in a field, then the width of the gores in degrees is, $b° = \frac{90}{n}$.

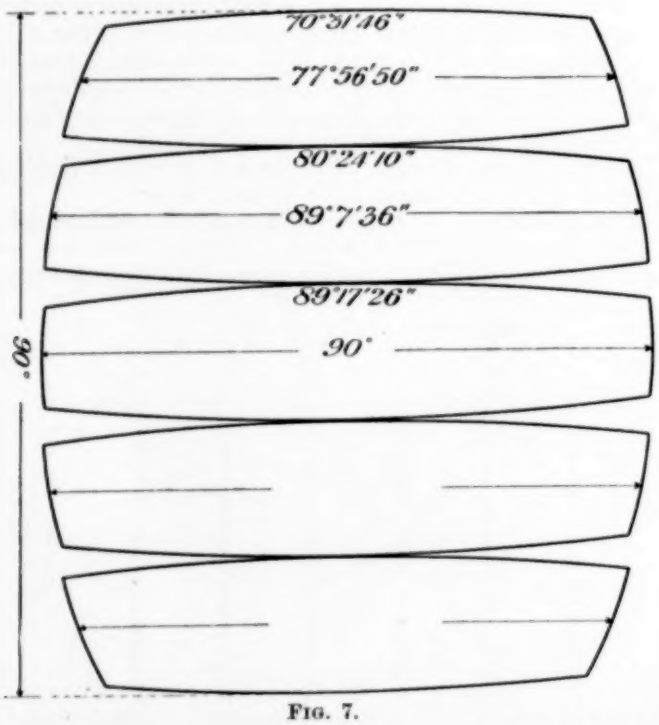


FIG. 7.

In the present case, with $n = 5$, $b° = 18$, and the meridional edges and central lines of the gores will have longitudes of 9°, 18°, 27°, 36°, and 45°, from which the lengths may easily be computed, and are entered in fig. 7.

In cutting out these gores the sloping-ended ones may be permitted to overlap in the manner already shown in fig. 5, the greatest economy being realized when a large number of the same kind of gores are cut from a continuous band. A saving of about 6 per cent can be effected in this way, for example, if the 12 small bands are cut together. If l is the length of the central line of a sloping-ended band and l_1 the length of the long edge, then the aggregate running length required to cut out n bands will be very nearly $nl + (l_1 - l)$. If many balloons are made n becomes a large number and the quantity $(l_1 - l)$ becomes negligible.

From these considerations the aggregate length of material necessary to cut the 30 gores required in the present case will be $\frac{14.047\ \pi^2 R^2}{10}$, and the width, not allowing for overlap at seams, will be $\frac{\pi R}{10}$.

$$\therefore \text{ area of material consumed} = \frac{14.047\ \pi^2 R^2}{10}.$$

$$\text{The surface of the sphere} = 4\pi R^2,$$

$$\text{and coefficient of economy} = \frac{40}{14.05\ \pi} = 90.6 \text{ per cent.}$$

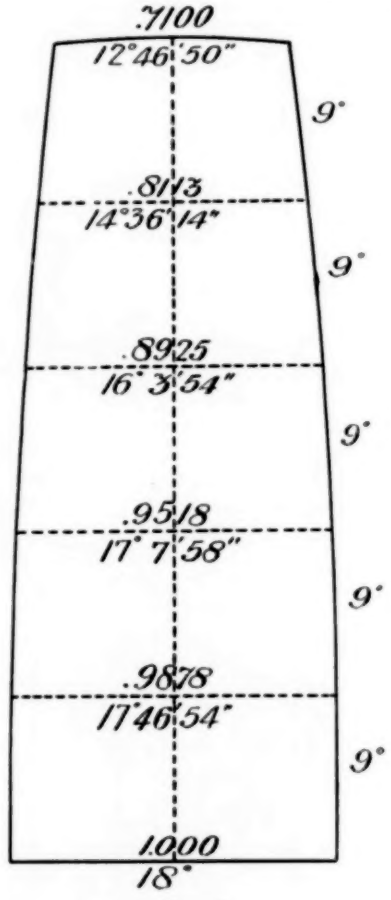


FIG. 8.

This shows a slightly higher economy than the zonal form, partly due to the assumed more favorable cutting of the sloping-ended gores.

To deduce the width of a gore at any point, let b equal the semi-width corresponding to the angular distance a from the equator of the gore, and b_0 the semi-width of the gore, in degrees at the equator, then, for radius = 1, we have the equation:

$$\tan b = \cos a \tan b_0.$$

In the quadratic fields a may vary from 0° to 45°; taking successive values of a at intervals of 9°, and assuming 5 gores to the field, viz, $b_0 = 9°$, we get the series of relative widths of the gore at successive points shown in fig. 8.

The overlap at seams may be treated in the following manner: In the case of 5 gores to a field, as shown in the foregoing illustrations, there will be in all 32 seams. The lengths of these, which correspond to the length of the edges of the gores, are given in fig. 7 and the sum is found to be 14.648 πR. An allowance of $\frac{3}{4}$ of an inch for overlap seems adequate, and in a balloon 10 feet in diameter this corresponds to about 4 per cent of the width of a gore. This figure may be adopted as convenient; hence, the area of seams is found to be 4.6 per cent of the area of the sphere.

The foregoing numerical data give all that is required in laying out balloons by this plan. In the case of rubber balloons its extreme extensibility renders a large number of gores unnecessary and no doubt a very good balloon can be made simply by uniting the six quadratic fields without subdivision, if large enough sheets of rubber were easily to be had. The maximum size of rubber balloons required in meteorological work will scarcely exceed 6 feet in diameter. The quadratic fields in such a balloon would be 56 inches wide, which is doubtless a greater width of rubber than is easily available. The field can be divided in the middle, necessitating only 12 exactly similar gores to make the balloons each 28 inches wide. The waste in cutting in these cases is a little greater than with a larger number of subdivisions.

BENJAMIN THOMPSON—COUNT RUMFORD.

By Mr. DANIEL T. PIERCE, JR.

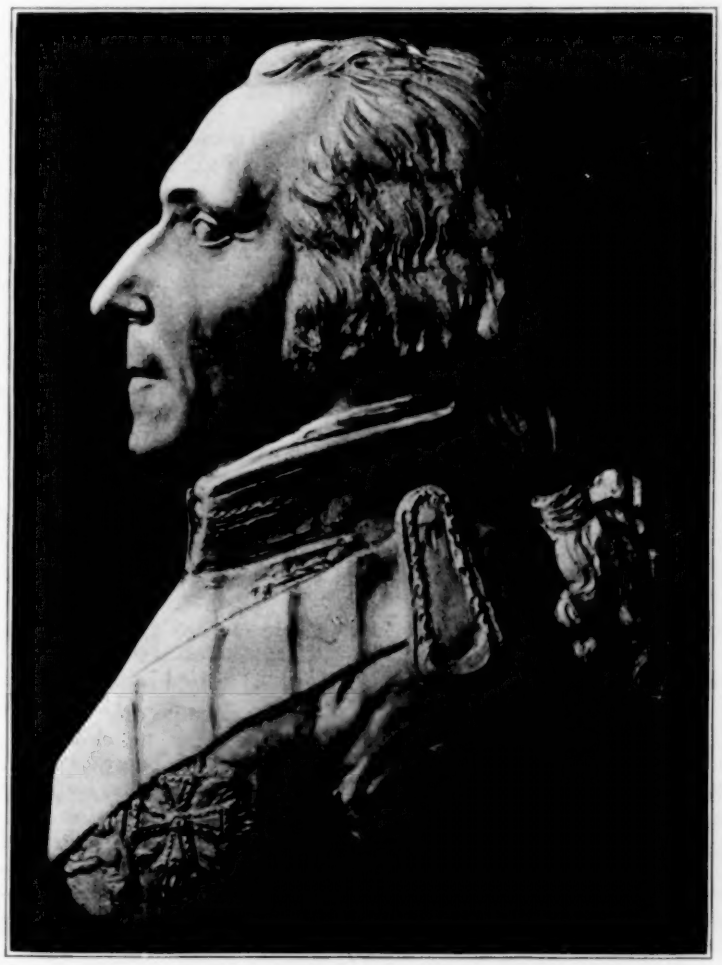
Born at Woburn, Mass., March 26, 1753. His father, Benjamin Thompson, and his mother, Ruth Simonds, came of the stock of the first colonists of Massachusetts Bay.

His education was obtained by his own efforts, seconded by instruction from his grandfather; he attended no school except the primary institutions of the town where he was born. "Before he was 14 he could calculate and trace rightly the elevation of a solar eclipse." (Bibliothèque Britannique.) A letter written by him in 1769 to a friend who had assisted him in his studies shows the trend of his mind at the age of 16:

> Please to give the direction of the Rays of Light from a Luminous Body to an Opake, and the Reflection of an Opake Body to another equally Dense and Opake; viz., the Direction of the Rays of the Luminous Body to that of the Opake, and the Direction of the Rays by Reflection to the other Opake Body. N. B. From the Sun to the Earth, Reflected to the Moon at an angle of 40 degrees.

His Tory sympathies caused him to flee to England at the outbreak of the Revolution. Became under-secretary for the colonies under Germaine. Later colonel of the King's American Dragoons, stationed on Long Island. Was proscribed by the New Hampshire alienation act of 1778. (In 1772 he had married at Rumford, now Concord, the widow of Colonel Rolfe.) Returned to England; made fellow of the Royal Society in 1779; knighted by George III in 1784. In the same year he received permission to travel on the Continent, where he met Charles Theodore, Elector of Bavaria, and was from that time to 1797 the dominant influence in the administration of the Electorate, privy counselor, and in command of the army. He continued his investigations in heat and light and invented many appliances for the more economic consumption of fuel, including a kitchen range in which it is claimed that dinner for 1000 persons could be cooked at a fuel expense of four and one-half pennies. Was made count of the Holy Roman Empire in 1791 by the Elector. His labors in the interest of the poor brought him great popularity. In 1795 a marble memorial was erected in his honor in the English Gardens (laid out by him) at Munich, bearing on one side a relief medallion in bronze; a replica of this was long ago made in ivory by an unknown artist and from that a photograph was made by Mr. Thomas B. Gardiner of Washington, D. C.

The ivory replica from which this photograph portrait is taken is now in the possession of Daniel Thompson Pierce, of Washington, D. C., descendant of Josiah Pierce, of Woburn, second husband of the mother of Count Rumford.



Benjamin Thompson—Count Rumford.

In 1796 he gave $5000 each to the Royal Society and the American Society of Arts and Sciences, founding in each case a prize for the most important discoveries in heat and light.

In 1799, the year of the publication of his voluminous essays, he established the Royal Institution of Great Britain. Faraday, who was director of the institution in 1825, accords to Rumford the title of discoverer of the law of the correlation of forces, which, in the words of the former, is the "Highest philosophical idea that the human mind has been able to grasp."

Rumford had intended that the Institution should be to a large extent devoted to industrial work and experimentation in directions which would be of practical value especially to the poor. Meeting opposition in carrying out plans to this end, he abandoned the Institution and went to France, where he married the widow of the famous chemist Lavoisier. He died at Auteuil, near Paris, August 21, 1814, at the age of 61.

THE CLOUD RING ON BUFFALO MOUNTAIN, COLORADO.

By Prof. R. DEC. WARD, Harvard University, dated August 3, 1903.

In his Philosophy of Storms (1841, foot note, pp. XXIV and XXV), Espy quoted a letter from Caleb Williams, dated December 20, 1839, describing the curious cloud which he had observed in 1815 on the island of Hawaii. This cloud, due to the combined action of the diurnal sea breeze and the upcast valley breeze, was observed to form soon after the sea breeze set in, at about 9 in the morning, and later surrounded "The lofty conical mountain in that island, in the form of a ring, as the wooden horizon surrounds the terrestrial artificial globe." The mountain stood in bold relief, and from where the ship lay the summit could always be seen above the cloud. This reference to the cloud ring of Hawaii has often been quoted, and the cloud has become, as it were, a "stock example" of this kind of thing.

One of the writer's students during the past winter (Mr. L. V. Pulsifer, of the class of 1903, HarvardCollege), contributed to the discussions on clouds which were held by the class in meteorology, the following account of a cloud ring which he had observed in Colorado during the summer of 1901. As these are peculiarly interesting clouds, the description may be worth quoting in the columns of the REVIEW.

Buffalo is a huge, roughly conical mountain, situated near the town of Dillon, Summit County, Colo. The general valley level at this point is about 8000 feet above the sea, and the mountain has a height of a little over 14,000 feet. I spent the summer of 1901 at Dillon, and on hot, still days noticed the formation of a cloud ring on Buffalo. This ring appeared at about noon, and was always at about the same height on the mountain side, roughly between timber line and snow line. The ring was not always perfect, but there was usually an incomplete ring even when the whole circuit was lacking. On the days when the ring was incomplete, the patches of cloud which did form were over the snow-filled gulches on the mountain side. During the middle of July and the first part of August the ring was best shown. * * * I do not recall whether this cloud ring ever reached a sufficient size to cause precipitation. It usually disappeared late in the afternoon.

ON CURVES REPRESENTING THE PATHS OF AIR IN A SPECIAL TYPE OF TRAVELING STORM.

By W. N. SHAW, Sc. D., F. R. S., Secretary of the Meteorological Council, dated August 25, 1903.

The instantaneous motion of air in a traveling storm may be regarded as approximately tangential to a series of concentric circles described about the barometric minimum as centre and representing isobaric lines. In any actual case there may be more or less "incurvature" of the air so that the lines of instantaneous motion are spirals instead of circles, and cross the isobars inwards. Moreover, in reality the isobaric lines themselves may be only more or less rough approximations to circles.

If the center of the storm (the barometric minimum) travels, the actual path of an isolated mass of air will be that described by a point which rotates with appropriate incurvature about a moving center. The real path will thus be a curve of no simple type and it will vary according to the speed at which the center travels. It can not be arrived at by superposing upon a simple rotational or spiral motion, a motion of translation equal to that of the center, because such superposition would alter the distribution of instantaneous velocities which represents the real instantaneous motion.

It is not difficult to calculate the actual paths for a special type of traveling storm making certain assumptions as to the velocities of the wind in different parts of the storm and the velocity of the center. As there are two kinds of motion to be considered, namely, that of the center, and that of the air masses, I propose, in order to avoid confusion, to limit the use of the word path to the motion of the center and to call the lines along which air travels "trajectories" of air.

The special case I propose to deal with is that in which the speed of the air is uniform over the area of the storm, although the direction varies from point to point. I shall also suppose the isobars to be true circles and the wind directions tangential to the isobars. Lastly the center will be regarded as describing a straight path with the same speed as the wind at any point. Whether this ideal state of things represents a possible reality is a matter for subsequent consideration.

Upon the hypothesis laid down, a "trajectory" is the curve described by a point rotating with uniform linear speed about a center moving with the same speed in a given direction. Take the path of the center as the x-axis of Cartesian coordinates and denote by θ the angle between the tangent to the trajectory and the positive direction of the path. The expression of the kinematical conditions must represent the fact that the center of curvature lies on the axis of x and moves along it with the same speed as the point along the trajectory. Expressing this condition we get the equation

$$y \sec^2 \theta \frac{d\theta}{ds} + \sec \theta = 1.$$

The same equation is obtained by equating the step along the curve to the step of the foot of the normal along the axis. Integrating the equation we get

$$y = \frac{c \cos \theta}{(1 - \cos \theta)},$$

c being an integration constant.

This equation represents a curve (see fig. 1) with a double

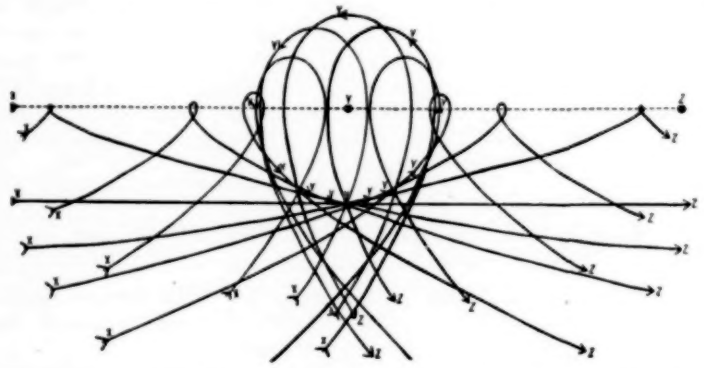


FIG. 1.—Calculated trajectories for the motion of air in a traveling circular storm when the velocity of the center is numerically equal to the wind velocity (assumed uniform) in the storm. XX. Initial positions of a series of particles and of the storm center. YY. Simultaneous position of the same particles when they lie on a circular isobar. ZZ. Final positions of the same particles and of the storm center.

point and a symmetrical loop above it. Taking a to be the ordinate of the top of the loop ($\theta = 180$), we get $c = -2a$ and $y + 2a \cos \theta / (1 - \cos \theta) = 0$ as the equation to the curve.

Substituting for $\cos \theta$ and integrating again we get

$$(a - y)\ (2a + y)^2 = 9\ ax^2$$

for the Cartesian equation of the curve when the axis of y is the line of symmetry of the loop.

The series of curves thus obtained for the trajectories is that represented in fig. 1; the intercepts on the axis of x are $\pm\ 2\sqrt{3}a$, and on the axis of y, a, and $2a$, representing the top of the loop and the double point, respectively. The curves of the family are similar in shape and are derivable one from the other by altering proportionally all linear dimensions. The one exception is the limiting case when $a = 0$ when the curve becomes a straight line parallel to the axis of x at an arbitrary distance from that axis and would represent the obvious result of a wind traveling parallel to the path of the storm at a fixed distance from the path.

It will thus be seen that the trajectories of air forming a revolving storm under the conditions described are widely different from the circular form represented by the isobars

and do not even approximate to the spiral motion generally assumed under such circumstances to represent the course of the air supplying the storm.

The relation of the trajectories to the moving center of the storm may be most easily considered by reference to the particle which moves parallel to the path and always occupies a position on the diagram immediately under the instantaneous center. The trajectories represented in fig. 1 are those of particles which will for one instant form a series of points, Y, on a circular isobar when the storm center reaches the appropriate position, also denoted by Y. Their motion will then be tangential to the circle. The simultaneous *initial* positions of these particles and the corresponding position of the storm center are denoted by X and the final positions of the same particles on the diagram are denoted by Z, the corresponding position of the storm center being also marked with the same letter. Supposing that these lines represent the trajectories of air in a real storm, and, further, for the sake of clearness, that the storm center travels from west to east, it is evident that the following conclusions may be drawn:

1. The more central area will be fed by wind with directions from south-southwest to west, passing to a region in front of the storm center.

2. When the storm center has passed, corresponding winds will blow out from behind the center with directions from west to north-northwest.

3. The winds from the remaining directions will be comparatively transient in any locality, as the changes take place with great rapidity. These winds are represented by the loops of the curve.

4. No air is taken into the storm area from the northern side of the path.

5. There is a great convergence of winds behind the center to the two points in the line of the "trough" of the storm. This convergence is associated with corresponding divergence in front of the trough and apparent crossing of the trajectories at the trough itself.

It is to these characteristics that we must look in deciding whether this ideal state of things represents the circumstances of any actual storm. For this purpose it is necessary to construct the actual trajectories of air from weather maps for a real storm. Generally speaking, weather maps are only drawn for such widely separated intervals that there is not enough information for the construction of the trajectories. If, however, the records from a sufficient number of automatic instruments are available intermediate maps can be drawn. This has been done in the Meteorological Office for every third hour during the passage of the storm of February 26–27, 1903.

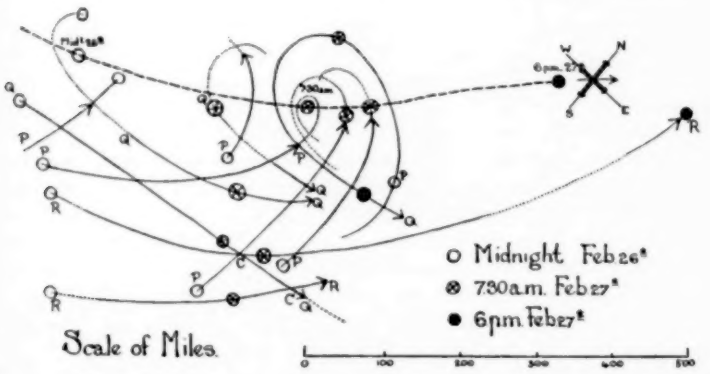


FIG. 2.—Trajectories of air in the storm of February 26–27, 1903, derived from records of wind. Those parts which are added by extrapolation from isobaric distribution are dotted. Path of center, - - - - - - - - - P, Trajectories of air passing to the front of the center. Q, Trajectories of air leaving the rear of the storm. R, Trajectories of air approximately parallel to the path of the center. C, Points of convergence and divergence on the trajectories parallel to the path.

The trajectories constructed from the recorded directions and velocities of the wind bear such a relation to the path of the center that the applicability of the kinematical reasoning here employed is quite unmistakeable. The material is of course not perfectly complete, but so far as it extends each of the characteristics enumerated above is represented with a fidelity quite unusual in the application of theoretical reasoning to the course of weather changes. A reproduction of some of the trajectories and of the path of the storm to the scale of the map is given in fig. 2. It will be seen that there is a strong general resemblance between the shapes of the curves in the two figures, the divergences are such as may be accounted for by supposing that the storm center was traveling rather more slowly than the wind. In comparing the two diagrams it is the shapes of the curves that should be regarded and not their actual position in the figure. The trajectories for the storm are taken from a series constructed by Mr. Lempfert from maps drawn by Mr. Brodie, of the Meteorological Office, and represent the paths of air producing conspicuous gales at various stations. Under the conditions of the question any one may be transferred parallel to itself along the line of the paths without serious modification, if required, to represent the path of the air reaching a particular point at a specified time, as in fig. 1. The points of resemblance to which attention should be directed are (1) the flow of air toward the front of the storm center, represented by the trajectories PP (fig. 2), from the directions within the quadrant S. to W. of the hypothetical case. As a matter of fact the storm in question traveled from southwest to northeast, roughly speaking, so that the specification of direction of wind requires adjusting when comparison is made with the hypothetical case. (2) The blowing out of air from behind the center, represented by the trajectories QQ. (3) The course of the trajectories RR, nearly parallel to the path, but converging slightly toward it as the wind gained upon the center. It is not necessary to suppose that the air moving along the P trajectories is identically the same as that moving along the Q trajectories; the former may rise in front of the center and be replaced by air which sinks behind it. (4) The convergence to points near CC, which are near the line of the trough at 7:30 a. m. and 9 a. m., respectively.

This convergence with its associated divergence in front of the trough raises an interesting meteorological question. It can only be accounted for by bringing the third dimension into consideration and supposing that the air rises when convergence takes place and descends from above when there is divergence. This would mean that the wind in front of the trough was supplied from the upper air while the motion behind the trough is in an upward direction. The latter must be associated with the production of rain. In this particular the agreement between the hypothetical and real trajectories is so close that the inferences to be drawn from it offer a promising field for inquiry into the physical changes associated with such storms. Into the investigation of these changes I do not propose to enter here. The primary conclusion I wish to draw is that the kinematical conditions represented by the hypotheses leading up to the equation

$$(a - y)\ (2a + y)^2 = 9ax^2$$

are sufficiently near to reality in some cases to identify a particular form of traveling storm.

Probably in nature three types of circular storms represented by a similar distribution of isobars about the center may be recognized. They are the following:

Type A. A stationary storm with spiral trajectories in which air is drawn from all sides. Type B. A storm traveling with a velocity approximating to that of the wind, as described above, in which air blows into the front of the storm and blows out from behind it. Type C. A storm moving comparatively

slowly and therefore intermediate between types A and B.

Some important physical and meteorological significance must be attached to the indraft of air to points in front of the center and not to the center itself. The trajectories representing the inflowing air may be continued, in the particular case referred to, for distances beyond the region of circular isobars, and it would therefore appear that these strong currents are not primarily due to the previous existence of a center of disturbance, but to some more dominant cause which directs their trajectories to points successively approached by the center of circulation. It may be noticed that the direction of motion of the center with regard to the motion of these dominant winds stands in the relation of west to southwest or of southwest to south, and possibly the inblowing wind may be the determining cause of the motion of the barometric minimum.

The details of the storm of February 26–27, 1903, for which the trajectories were drawn are given in a paper read before the Royal Meteorological Society on June 17, 1903.

THE METEOROLOGICAL WORK OF THE EXPEDITION TO THE BAHAMAS.[1]

By Dr. O. L. Fassig, Section Director.

Leaving Baltimore June 1 on the two-masted schooner *W. H. Van Name*, with the scientific expedition sent out under the auspices of the Baltimore Geographical Society, I arrived at Nassau, Bahama Islands, on June 17. Storms, calms, and head winds marked the entire voyage outward, making it difficult to secure reliable instrumental records of the weather and temperature of the water. However, some interesting results were obtained which will be discussed in a separate report. Arriving at Nassau, a thermograph, barograph, hydrograph, and pluviograph were installed at the cable office by the courtesy of Mr. P. H. Burns, superintendent of the Bahamas cable. Mr. Burns also kindly attended to these self-recording instruments during my absence from Nassau, enabling me to obtain continuous records of the temperature, pressure, humidity, and time of occurrence of rain for a period of about thirty days, from June 20 to July 20. From the colonial records I had copied the monthly and annual mean values of meteorological observations for a period of five years.

During my short stay of two weeks at Nassau I succeeded in obtaining some interesting records of temperature, pressure, and humidity of the upper atmosphere by means of the Weather Bureau kite equipment, which I hope will also prove to be of some value in defining the vertical rate of change in atmospheric conditions in these latitudes. Light winds are the rule in the islands during the summer months, and it was only on a few occasions that favorable opportunities were presented for flying kites. However, five ascents were made to elevations varying from 3500 to approximately 8000 feet. The highest elevation was attained by the use of a launch. Steaming into the wind we were enabled to obtain a somewhat increased wind velocity. Apparently the wind velocity decreases rapidly after an elevation of 5000 to 6000 feet, it being difficult to detect any motion in the clouds above the lower cumulus layer. The results will be discussed at the earliest opportunity.

On the return trip, which was made under more favorable conditions than the outward voyage, an interesting series of observations of water temperatures was made from Nassau to Baltimore. While passing through the Gulf Stream the temperature of the water was noted every half hour or oftener. Good records were also obtained by means of the thermograph, barograph, and hydrograph.

In addition to the meteorological duties noted above, a magnetic survey of the islands was made. Declination, dip, and relative intensity were measured on the islands of New Providence, Hog, Watlings, Long, and Abaco. Observations made in past years in these islands included only the element of declination. A self-registering tide gage was also installed by me. The magnetic instruments and tide gage are the property of the United States Coast and Geodetic Survey.

The generous cooperation of the Weather Bureau with the Baltimore Geographical Society has been greatly appreciated by the director of the expedition, and due acknowledgments will be made in the official publications of the results of the expedition.

[1] Under date of August 1, Dr. O. L. Fassig reports his return to Baltimore from the Bahama Island, and gives some idea of the work accomplished.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the rain was uncommonly scarce, the month showing regular alternations of short periods of two, three, and four days of drought, separated by others of one and two days with moderate rainfall. On the 25th the rain began falling daily and the 28th, 29th, and 31st were marked by heavy showers. In San José, pressure and temperature were about normal, and the relative humidity a little less than the mean. Sunshine, 144 hours against a normal of 119. On the Atlantic slope also there was a scarcity of rain, excepting at a few stations at the foot of the Cordillera and at Turrialba and Paraiso in the Reventagon Valley, where the fall showed an excess. On July 10 a cyclone crossed the plains of Sta. Clara in an E–W direction, causing much damage to the banana plantations.

Notes on earthquakes.—July 23, $7^h\ 20^m$ a. m., slight shock NW–SE, intensity II, duration 3 seconds.

OBSERVATIONS OF SOLAR RADIATION WITH THE ANGSTROM PYRHELIOMETER AT ASHEVILLE AND BLACK MOUNTAIN, N. C.

By Mr. H. H. KIMBALL, Assistant Editor, Monthly Weather Review, dated July, 1903.

The Ångström compensating pyrheliometer, No. 28, used by Davis and Pierce[1] at Providence, R. I., from November, 1901, to September, 1902, was installed by me at Asheville, N. C., on November 8, 1902, in accordance with instructions received from the Chief of Weather Bureau. The point selected for its exposure was on the lawn just south of the Ravenscroft Hotel, near the crest of a ridge running north and south, with a slight dip to the south. The business portion of the town lay to the north and east, and as soft coal was almost the only fuel used the smoke at times became quite dense, particularly with light northerly winds.

The arrangement of circuits was as described by Professor Marvin in the MONTHLY WEATHER REVIEW for October, 1901, Vol. XXIX, p. 456. At first the galvanometer was suspended from the south side of the trunk of a large and nearly branchless locust tree, instead of from the tripod, as shown in fig. 1. Here an unobstructed view of the sun was had from the time it appeared above Beaumont Mountain, about a mile distant, some fifteen minutes after the time of true sunrise, until it set behind mountains nearly 20 miles distant, the tops of which were only one or two degrees above the true horizon. Winds above 20 miles per hour caused such annoying oscillations in the galvanometer that on December 22 it was moved to a post at the southeast corner of the hotel porch, where it was well protected from the prevailing northwest winds; but at noon and again at 4 p. m. the tripod support of the pyrheliometer had to be moved a few feet to avoid the shadow of shade trees.

On December 2, a Pickering polarimeter[2] loaned by Prof. E.

[1] See Monthly Weather Review for June, 1903, p. 275.

[2] For a description of this instrument see Proc. Amer. Acad. of Arts and Sci. N. S. Vol. XIII. Pp. 294–302.

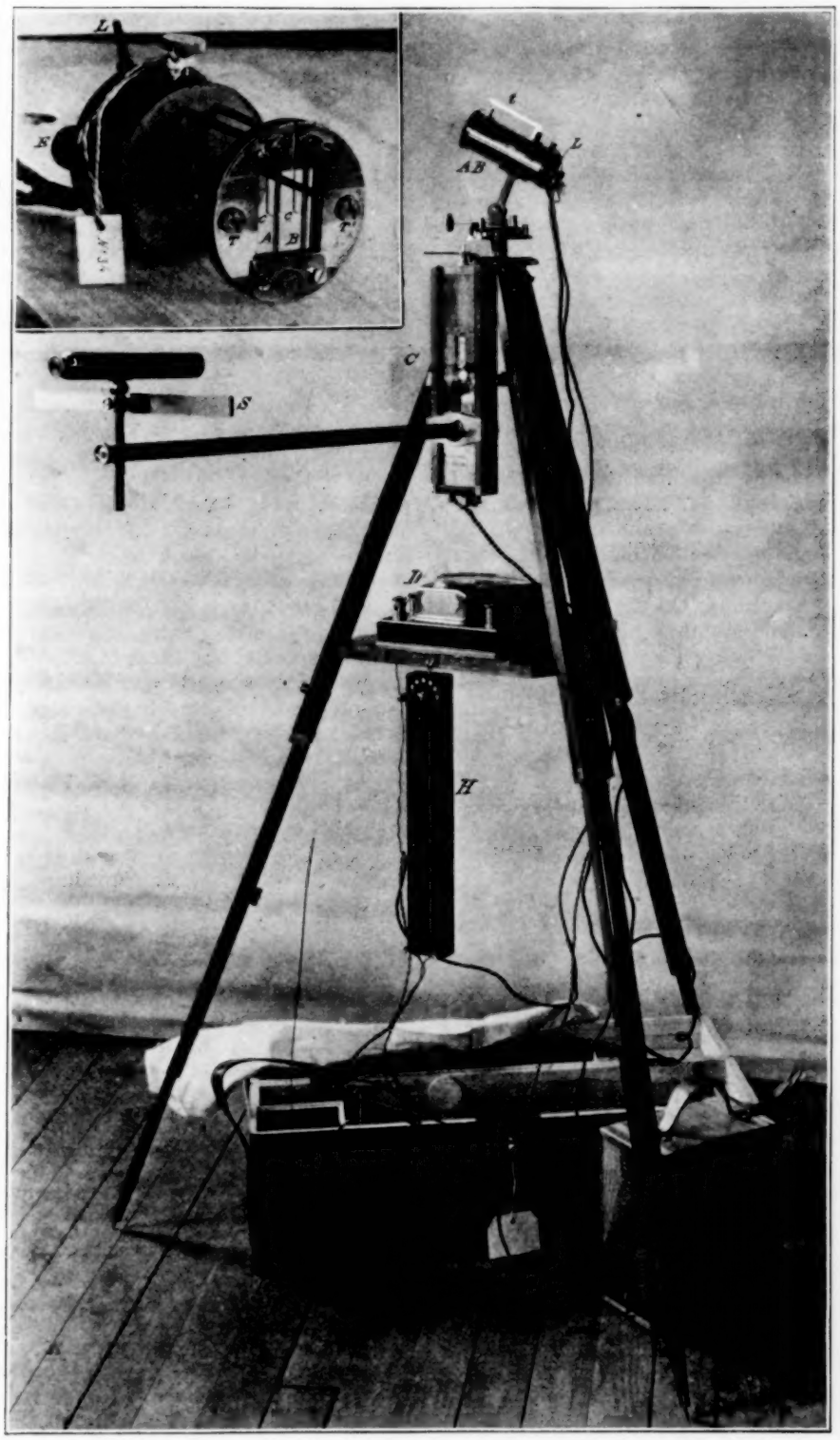


FIG. 1.—Ångström's portable electrical compensating pyrheliometer.

C. Pickering, was installed on the lawn, and proved to be admirably adapted for measuring the polarization of blue sky light; the altazimuth mounting was crude and the position of the sun could not be determined closer than to within half a degree in azimuth and altitude; the pointing of the telescope was liable to be disturbed during an observation, since the vertical circle could not be clamped.

Wishing, if possible, to obtain observations unaffected by smoke, the instruments were, on February 16, 1903, removed to Black Mountain, N. C., about 16 miles east of Asheville, and there installed in an open field surrounded by forest trees, back of which were mountain ranges from 2 to 7 miles distant, in all directions except west. The only smoke of any importance at this point was from trains on the Southern Railway, which passed about half a mile south of the station.

The galvanometer was suspended from the north side of a post, about 10 inches in diameter, set 3 feet in the ground. The surrounding forests and mountains broke the force of the wind somewhat, but the oscillations produced in the galvanometer by even a moderately brisk wind were very annoying.

At Asheville the instruments were generally read and data recorded in the following order:

1. Galvanometer scale, with bands *A* and *B* of the pyrheliometer both exposed to the sun.
2. Attached thermometer of pyrheliometer.
3. Watch time.
4. Ammeter, with band *A* of pyrheliometer exposed (the left band, as seen when looking from the rear) and current passing through *B*.
5. Ammeter, with band *B* exposed (the one on the right, as seen from the rear) and current passing through *A*.
6. Same as 5.
7. Same as 4.
8. Watch time.
9. Attached thermometer of pyrheliometer.
10. Sling psychrometer.
11. Character of wind and kind and amount of clouds.
12. Galvanometer scale, with bands *A* and *B* of the pyrheliometer both exposed to the sun.
13. Polarimeter, the tube being first sighted on the sun and the azimuth and altitude read off. The tube was then revolved about its horizontal axis to a point in the sky 90° from the sun and on the same vertical circle with it, where four readings, or two determinations, of the polarization of the sky light were made while revolving the Nicol prism in a clockwise direction and the same number while revolving it in the opposite direction.
14. The blueness of the sky 90° from the sun and the clearness with which distant mountains could be seen were each recorded on the scale 0–10.

At Black Mountain the sling psychrometer (item 10) was read last.

Table 1 shows all the details of the observations with the pyrheliometer and the polarimeter as actually recorded on February 4, 1902. The morning observations on this day were made through clouds, and the marked fluctuations in the solar radiation and the polarization of sky light will be noted. The afternoon observations were made under favorable conditions, except that the wind was high. The readings of the polarimeter were fairly regular until after sunset, when darkness made accurate observing difficult.

It will be noted that with band *A* of the pyrheliometer exposed, less current was required to bring about thermoelectric equilibrium, as indicated by the galvanometer, than with band *B* exposed, the average difference from 12:31 p. m. to 5:05 p. m. being 0.028 ampere. The principal exceptions to the rule were when the sun was just above the horizon. In this position its radiation was subject to absorption and reflection from so many sources that irregularities in the readings were to be expected.

This apparent difference in bands *A* and *B* has been the subject of much speculation. As has already been indicated, each observation requires that the heating effect of the sun on one of the bands be balanced against the heating effect of an electric current on the other band four times in succession, the bands being exposed to the sun in the following order:

(1) *A* exposed; (2) *B* exposed; (3) *B* exposed; (4) *A* exposed. The mean current required to balance the heating effect of the sun for each of these exposures—(1), (2), (3), and (4)—has been computed for the four following series:

November series: 50 observations at Asheville between November 10 and 15. January series: 50 observations at Asheville between January 12 and February 13. Black Mountain series: 43 observations at Black Mountain between February 19 and March 25. Washington series: 12 observations at Washington, D. C., in April, 1903. The results are given in Table 2.

The departure from mean of Table 2 may be compared with columns 6, 7, 8, and 9, of Davis's Table 2,[3] remembering that his readings were made in the reverse order from mine; that is, the order of exposure of the bands in his case was *B*, *A*, *A*, *B*, while in mine it was *A*, *B*, *B*, *A*.

The rhythm in the readings has the same order of sequence in both cases, though less marked in mine than his, and is undoubtedly due to lag in the heating and cooling of the bands. This lag was especially noticeable with band *A* exposed. If sufficient current was switched on to quickly heat *B* to the temperature of *A*, *B* became overheated, and it was necessary to diminish the current. A succession of increases and decreases in the current would follow, until thermoelectric equilibrium was established. The lag was noticeable to a less degree with band *B* exposed.

The mean current with *A* exposed averaged 0.0276 ampere less than with *B* exposed in my work, as compared with 0.0226 ampere less in the work of Davis. The difference 0.005 is only one scale division on the ammeter and is not larger than we would expect, since the difference in the order of exposure brought the effect of lag upon different strips. The mean of (1) and (2) in my case is 0.0016 ampere greater than the mean of (3) and (4), while Davis found the mean of (3) and (4) to be 0.0023 the greater.

TABLE 1.—*Original record of pyrheliometer and polarimeter observations at Asheville, N. C., February 4, 1903.*

Radiation—Pyrheliometer.						Polarization.										
Time.	Attached therm'r.	Band exposed.			Mean of *A* and *B*.	*Q*.	Time.	Sun's—			Polarimeter readings.								
		A and *B*.	*A*.	*B*.				Azimuth.	Altitude.	Altitude +90°.	1.	2.	3.	4.	2-1.	4-3.	4 V.	*P*.
	°C.	*Gal.*	*Amm.*	*Amm.*	°			°	°	°								
9:30 a. m.	16.0	119.5	142	137	137	0.159	9:43 a. m.	310.4	22.2	112.2	96.1	174.5	278.1	355.3	78.4	77.2	155.6	21.1
9:37 a. m.	17.9	129.7	271	254	262	0.563	9:48 a. m.	310.4	.....	112.2	95.2	179.2	274.0	352.5	84.0	78.5	162.5	15.2
10:30 a. m.	17.1	123.0	106	99	102	0.090	10:50 a. m.	325.5	31.0	121.0	97.9	173.0	278.2	353.0	75.1	74.8	149.9	26.0
10:44 a. m.	16.1	123.0	69	36	52	0.026	10:55 a. m.	325.2	.....	117.0	99.5	171.5	279.8	351.2	72.0	71.4	143.4	31.4
11:48 a. m.	15.0	123.2	36	22	29	0.009	12:06 p. m.	346.9	37.0	127.0	104.1	167.0	282.2	346.1	62.9	63.9	126.8	44.8
11:58 a. m.	16.2	123.0	143	25	84	0.062	12:11 p. m.	347.0	.....	126.5	104.2	166.2	284.8	347.0	62.0	62.2	124.2	46.8
12:31 p. m.	18.5	122.5	351	369	360	1.041	12:49 p. m.	359.3	37.5	127.5	104.0	166.1	285.2	346.1	62.1	60.9	123.0	47.7
12:43 p. m.	18.0	123.0	342	368	355	1.012	12:53 p. m.	359.3	.....	127.2	103.6	166.1	284.6	346.1	62.5	61.5	124.0	47.0
1:30 p. m.	17.9	124.0	335	361	348	0.971	1:48 p. m.	16.9	35.2	125.2	103.5	166.1	284.7	346.7	62.6	62.0	124.6	46.5
1:42 p. m.	17.8	124.1	335	360	348	0.971	1:54 p. m.	16.9	.....	124.7	104.1	166.2	284.1	346.4	62.1	62.3	124.4	46.7
2:57 p. m.	18.0	124.5	322	350	336	0.912	3:12 p. m.	38.7	27.1	117.1	103.5	165.8	284.3	346.3	62.3	62.0	124.3	46.8
3:06 p. m.	17.1	124.5	311	343	327	0.865	3:18 p. m.	38.7	.....	116.8	103.9	165.9	284.2	346.1	62.0	61.9	123.9	47.1
4:09 p. m.	16.1	122.0	287	305	296	0.715	4:18 p. m.	52.3	17.0	107.0	103.2	167.1	283.9	346.8	63.9	62.9	126.8	44.8
4:12 p. m.	15.6	122.0	273	305	289	0.682	4:23 p. m.	52.3	.....	107.0	103.7	166.8	284.1	346.9	63.1	62.8	125.9	45.5
4:57 p. m.	13.3	116.0	221	255	238	0.465	5:11 p. m.	61.5	8.0	97.0	101.5	168.0	282.2	348.2	66.5	66.0	132.5	40.3
5:05 p. m.	13.3	117.7	217	255	236	0.454	5:16 p. m.	61.1	.....	97.0	101.7	168.1	281.9	348.3	66.4	66.4	132.8	40.1
5:40 p. m.	10.9	132.0	129	121	125	0.133	*5:52 p. m.	67.5	0.0	90.2	100.3	169.4	282.0	348.9	69.1	66.9	136.0	37.5
5:49 p. m.	10.6	132.0	86	104	95	0.079	*6:02 p. m.	68.9	.....	88.5	107.5	162.9	289.0	342.0	55.4	53.0	108.4	58.5
							*6:12 p. m.	70.3	.....	86.8	106.5	165.0	285.0	345.9	58.5	60.9	119.4	50.5
							*6:19 p. m.	71.7	.....	85.1	105.0	165.1	286.1	344.6	60.1	58.5	118.6	51.1

NOTE.—Watch 15 seconds fast. *After sunset; sky pink and yellow to zenith and very brilliant.

[3] See Monthly Weather Review for June, 1902, p. 277.

TABLE 2.—*Mean current with different pyrheliometer exposures.*

Series.	Exposure.				
	(1)	(2)	(3)	(4)	Mean.
Asheville:					
November	.306	.331	.328	.306	.318
January	.273	.302	.299	.269	.285
Black Mountain:					
February and March	.269	.306	.300	.275	.288
Washington:					
April	.311	.342	.338	.317	.327
Weighted means	.2855	.3157	.3115	.2864	.2998

Series.	Departure from mean.				$\frac{(2)+(3)}{2} - \frac{(1)+(4)}{2}$
	(1)	(2)	(3)	(4)	
Asheville:					
November	−.012	+.013	+.010	−.012	+.0235
January	−.012	+.017	+.014	−.016	+.0295
Black Mountain:					
February and March	−.019	+.018	+.012	−.013	+.0310
Washington:					
April	−.016	+.015	+.011	−.010	+.0260
Weighted means	−.0143	+.0159	+.0117	−.0134	+.0276

The shifting of the zero point of the galvanometer scale (i. e., the reading with zero current when *A* and *B* are both exposed) is referred to by Davis and is shown in column 3 of Table 1. This appears to be purely a temperature effect. While installing the apparatus at Asheville on November 8, with the sun shining directly upon the galvanometer, it was found that when cumulus clouds were passing over the sun the zero of the scale shifted so rapidly that it was impossible to make observations. A wooden box was therefore arranged so as to shade the galvanometer, and with excellent results. The slow movements shown in Table 1 are quite unimportant. The marked difference between 5:05 p. m. and 5:40 p. m. is due to a readjustment of the instrument.

After each reading of the ammeter the current was immediately cut off. At the completion of each series of four readings band *A* was thus left exposed to the sun for some seconds, while band *B* was shaded and without any current passing through it. The shutter was then generally arranged so as to expose both *A* and *B*, to redetermine the zero of the galvanometer; but so much time was required for *B* to acquire the temperature of *A* that frequently I detached one of the galvanometer wires, or opened the circuit, so as to obtain the zero of the scale at once. A great many readings showed no appreciable difference between the zero determined by *opening the circuit* and that determined by a long exposure of both bands to the sun.

TABLE 3.—*Corrections to Weston ammeter No. 4315.*

Scale reading.	By Bureau of Standards.	By ammeter No. 4321.	By H. M. Davis.	
			Nov., 1901.	April, 1902.
0	+5.5	+6.5	+8.0	+8.0
50	5.0	5.0	8.0	7.2
100	5.5	6.0	8.0	8.0
150	4.5	4.5	7.0	6.4
200	5.0	5.0	7.0	7.0
250	4.5	4.8	6.0	7.4
300	4.5	5.3	6.0	6.8
350	3.0	5.0	5.0	4.8
400	2.0	3.8	4.0	3.8
450	+1.0	2.7	+2.0	+2.7
500	−0.5	+1.0	±0.0	±0.0

Upon returning to Washington, steps were at once taken to determine, if possible, the corrections to Weston ammeter No. 4315 and pyrheliometer No. 28. The ammeter was first compared with a similar instrument, No. 4321, which had recently been calibrated by the Bureau of Standards, and was then taken to that bureau for a direct determination of its errors. In the method adopted by this bureau the current corresponding to a given scale reading was determined by measuring the fall in potential of the current in passing through a known resistance. Table 3 shows the results of these tests, as also those obtained by Davis, who compared this ammeter with a Thomson current balance belonging to the laboratory of Brown University.

The corrections determined directly by the Bureau of Standards have been applied to all my readings at Asheville and Black Mountain.

On April 9 pyrheliometer No. 28 was compared with pyrheliometer No. 34, the latter having been kept in the Instrument Division of the Weather Bureau ever since it was purchased, in 1901. The temporary support provided for the galvanometers was quite unstable, and clouds commenced to form soon after observations were begun, so that only two complete sets of readings were obtained. These are given in Table 4.

TABLE 4.—*Comparison of pyrheliometers, April 9, 1903.*

Time.	No. 28.					No. 34.				
	Temperature.	Band exposed.			Q'.	Temperature.	Band exposed.			Q'.
		A and *B*.	*A*.	*B*.			*A* and *B*.	*A*.	*B*.	
	°C.	*Gal.*	*Amp.*	*Amp.*	*Cal.*	°C.	*Gal.*	*Amp.*	*Amp.*	*Cal.*
2:10 p. m.	24.7	112.0	0.312	0.317	0.801	23.6	134.0	0.340	0.355	0.876
2:15 p. m.	24.8	112.0	0.310	0.323	0.811	24.0	134.0	0.345	0.355	0.887
2:27 p. m.	24.2	111.0	0.317	0.305	0.786	23.8	137.0	0.345	0.325	0.812
2:42 p. m.	25.0	112.0	0.300	0.303	0.741	24.8	137.0	0.335	0.321	0.779
Means					0.7848					0.8385

The mean value of the solar radiation as measured by No. 28 was only 93.6 per cent of the radiation as measured by No. 34. This result may be compared with the comparative readings of these same instruments obtained by Professor Marvin[4] in October, 1901, when the mean of ten observations with No. 34 gave for the radiation 0.8096, while simultaneous observations with No. 28 gave 0.7424, or only 91.7 per cent of the result by No. 34.

Furthermore, Professor Marvin's readings show for exposures (1), (2), (3), and (4) of each observation, the values given in Table 5, the bands having been exposed in the same order as by me, i. e., *A*, *B*, *B*, *A*.

TABLE 5.

	Exposures.					$\frac{(2+3)}{2} - \frac{(1+4)}{2}$
	(1)	(2)	(3)	(4)	Mean.	
Amperes	0.2920	0.3237	0.3187	0.2873	0.3055	+0.0316
Residuals	−0.0135	+0.0182	+0.0132	−0.0182		

Comparing Table 5 with Table 2 and with Davis's Table 2, we find no evidence of any change having occurred in pyrheliometer No. 28 since October, 1901; and if we assume that the observations of October 29, 1901, and April 9, 1903, are equally good, it follows that No. 28 gives results that are 92.0 per cent of those given by No. 34.

A very critical examination of the bands *A* and *B* of No. 28 showed that the platinum foil of *B* had buckled so as to separate it slightly from the copper foil back of it, just over the thermoelectric junction. This will explain why, with *A* exposed, a long time was required for the electric current to bring the temperature at the thermoelectric junction on *B* up to the temperature of the junction on *A*. It will also explain why, after exposure (4), with the sun left shining on *A*, when the shutter was adjusted to expose both bands considerable

[4] See Monthly Weather Review, October, 1901, Vol. XXIX, pp. 457–458.

time was required to bring about thermoelectric equilbrium at the back of the bands. It does not explain why with band *A* exposed less current was required to balance the heating effect of the sun than with band *B* exposed. In fact, we should expect the opposite effect.

An attempt was made by the Instrument Division to measure the resistance of bands *A* and *B*, but, unfortunately, the surface of *B* was scratched slightly and some of the platinum block removed.

The comparative readings of Nos. 28 and 34 made after this accident occurred are shown in Table 6 and are of interest.

TABLE 6.—*Comparison of pyrheliometers Nos. 28 and 34.*

Time.	No. 28.					Time.	No. 34.				
	Temperature.	Band exposed to sun.			Q.		Temperature.	Band exposed to sun.			Q.
		A and *B*.	*A*.	*B*.				*A* and *B*.	*A*.	*B*.	
April 28.	°C.	*Galvanometer.*	*Ammeter.*	*Ammeter.*	*Calories.*	April 28.	°C.	*Galvanometer.*	*Ammeter.*	*Ammeter.*	*Calories.*
9:54 a. m.	23.9	110.9	353	339	0.965	10:08 a. m.	24.8	123.5	387	392	1.101
10:06 a. m.	23.0	114.0	351	337	0.952	10:18 a. m.	24.0	122.0	393	392	1.113
10:38 a. m.	23.8	116.0	361	347	1.009	10:22 a. m.	24.8	121.9	391	387	1.095
10:46 a. m.	25.9	114.0	375	337	1.021	10:35 a. m.	25.5	121.5	388	379	1.068
10:59 a. m.	24.8	116.0	362	329	0.965	10:47 a. m.	25.4	120.4	379	402	1.101
11:09 a. m.	26.5	116.0	357	338	0.977	10:57 a. m.	26.0	121.0	393	402	1.147
11:14 a. m.	25.2	117.0	363	350	1.021	11:25 a. m.	26.5	118.0	402	401	1.172
11:23 a. m.	26.5	114.0	372	344	1.033	11:34 a. m.	26.5	117.9	398	405	1.172
11:48 a. m.	25.9	116.5	369	341	1.015	11:36 a. m.	26.9	118.3	384	398	1.109
11:56 a. m.	26.9	115.5	373	346	1.045	11:46 a. m.	27.8	119.9	395	403	1.154
12:01 p. m.	27.4	115.0	364	342	1.005	12:13 p. m.	26.0	115.5	392	401	1.137
12:09 p. m.	27.8	114.5	372	332	0.999	12:23 p. m.	28.6	120.0	384	398	1.109
12:37 p. m.	27.9	116.8	368	343	1.022	12:26 p. m.	28.7	120.0	386	395	1.103
12:48 p. m.	28.0	116.5	372	337	1.010	12:35 p. m.	28.7	120.5	394	393	1.125
1:25 p. m.	28.0	117.9	363	348	1.022	1:39 p. m.	29.0	119.0	379	393	1.081
1:35 p. m.	30.5	118.5	369	332	0.989	1:50 p. m.	30.0	120.2	366	381	1.015
2:04 p. m.	30.9	121.0	361	338	0.989	1:54 p. m.	29.9	121.0	387	392	1.104
2:14 p. m.	30.7	124.5	362	337	0.989	2:02 p. m.	30.0	121.5	388	394	1.110
2:27 p. m.	30.0	126.0	356	337	0.967	2:16 p. m.	29.8	121.7	389	396	1.117
2:34 p. m.	31.1	126.0	364	325	0.956	2:24 p. m.	29.3	120.2	391	398	1.127
Means					0.998						1.113

Time.	No. 28.					Time.	No. 34.				
	Temperature.	Circuit open.	Band exposed.		Q.		Temperature.	Band exposed to sun.			Q.
			A.	*B*.				*A* and *B*.	*A*.	*B*.	
April 29.											
11:08 a. m.	28.2	125.5	310	348	0.879	11:17 a. m.	29.9	127.2	364	369	0.973
11:15 a. m.	28.5	125.5	312	349	0.885	11:30 a. m.	30.8	128.0	364	368	0.973
11:48 a. m.	30.0	126.5	310	326	0.823	11:36 a. m.	30.8	129.0	363	366	0.962
11:56 a. m.	29.7	127.0	316	337	0.864	11:44 a. m.	31.2	128.7	366	364	0.967
11:57 a. m.	29.8	127.0	311	342	0.864	12:08 p. m.	30.9	130.0	367	372	0.994
12:06 p. m.	29.7	127.0	319	329	0.854	12:14 p. m.	30.9	130.0	366	371	0.983
April 30.											
11:49 a. m.	35.3	109.0	319	362	0.936	11:59 a. m.	34.9	133.0	377	383	1.050
11:57 a. m.	35.1	109.0	321	361	0.942	12:07 p. m.	34.0	133.0	379	382	1.050
12:22 p. m.	33.1	111.0	326	356	0.941	12:11 p. m.	35.0	134.0	380	379	1.050
12:31 p. m.	33.9	111.0	325	364	0.957	12:18 p. m.	34.0	131.0	381	378	1.050
May 1.											
10:25 a. m.	12.4	124.5	344	385	1.061	10:36 a. m.	13.0	126.5	401	406	1.175
10:32 a. m.	12.0	124.5	343	391	1.079	10:43 a. m.	13.0	126.5	410	400	1.181
10:57 a. m.	12.5	124.0	341	382	1.050	10:45 a. m.	13.1	126.5	402	410	1.188
11:07 a. m.	12.1	124.0	339	380	1.021	10:53 a. m.	12.9	129.0	400	410	1.175
Means					0.940						1.055

On April 28, 1903, the zero of the scale was determined with both bands exposed to the sun. The change in the sign of the difference between the ammeter readings with the current through bands *A* and *B*, respectively, was noted, and investigation showed that the zero of the scale thus determined was about 25 scale divisions in error; in other words, with both bands exposed to the sun there was a current through the galvanometer, due to the fact that *A* acquired a higher temperature than *B*. On April 29, 30, and May 1 the zero of the scale was determined with the circuit open. Very little error in Q' resulted from this erroneous determination of the zero of the scale on April 28, however, since the mean radiation, as measured by No. 28 on that date, was 89.6 per cent of the radiation as measured by No. 34, while on April 29, 30, and May 1 it was 89.1 per cent.

Computing, for No. 28, the mean current employed with exposures (1), (2), (3), and (4) on April 29, 30, and May 1 we obtain the following:

	Exposures					$\frac{2+3}{2} - \frac{1+4}{2}$
	(1)	(2)	(3)	(4)	Mean.	
Amperes	0.323	0.357	0.359	0.325	0.341	+0.034
Residuals	−0.018	+0.016	+0.018	−0.016		

I can not account for the residuals remaining so nearly as before, while the deflection of the galvanometer with both bands exposed shows that *A* absorbed so much more heat than *B*, unless the resistance of *B* was increased when its surface was scratched, as may have been the case when we consider its extreme thinness. This would also seem to indicate that the reason why band *B* has all along required less current to heat it than band *A* is that a slight fracture at the point where it buckled increased its resistance. A second accident to band *B*, while an attempt was being made by the Instrument Division to blacken the scratched surface, damaged it so seriously as to prevent further investigation of its errors.

Early in June, 1903, a new set of bands, equivalent to a new pyrheliometer, and called by Ångström No. 41, was received by the Weather Bureau apparently in excellent condition, and the comparative readings in Table 7 were made.

The means of the 6 sets of readings by the two instru-

ments differ from each other by less than 1 per cent. On October 25, 1902, Professor Marvin[5] compared pyrheliometer No. 34 with No. 31, the mean of the results by No. 31 being 1.106 calories, and by No. 34, 1.100 calories, also a difference of less than 1 per cent. The Ångström pyrheliometers Nos. 31, 34, and 41 are therefore in practical agreement, while the indications of No. 28 are only 92 per cent of the indications by the other three, and it is fair to assume that this difference has been constant ever since the instrument was received in October, 1901. The values of the radiation indicated by No. 28 have therefore been divided by 0.92 to obtain the Q of Tables 8 and 9. This Q is believed to be comparable with the results obtained by Ångström with his similar and standard instrument in Europe.

TABLE 7.—*Comparison of pyrheliometers Nos. 41 and 34.*

Time.	Pyrheliometer No. 41.				Time.	Pyrheliometer No. 34.				
	Temperature.	Band exposed to sun.		Q.		Temperature.	Band exposed to sun.		Q.	
		A and *B*.	*A*.	*B*.			*A* and *B*.	*A*.	*B*.	
June 16.	°C.	*Galvanometer.*	*Ammeter.*	*Ammeter.*	*Calories.*	June 16.	°C.	*Galvanometer.*	*Ammeter.*	*Ammeter.*	*Calories.*
10:54 a. m.	28.8	117.5	388	384	1.053	11:03 a. m.	29.5	131.0	375	384	1.059
11:00 a. m.	28.2	120.0	388	384	1.052	11:09 a. m.	30.0	128.5	374	383	1.048
11:18 a. m.	28.5	120.0	389	386	1.064	11:11 a. m.	30.5	128.5	374	382	1.048
11:24 a. m.	29.0	121.0	385	385	1.048	11:16 a. m.	30.5	128.5	377	380	1.048
June 18.						June 18.					
9:43 a. m.	22.8	109.5	381	384	1.029	9:55 a. m.	24.8	126.8	376	370	1.025
9:51 a. m.	22.9	109.5	385	389	1.056	10:04 a. m.	26.0	126.5	375	375	1.036
10:20 a. m.	24.8	110.0	382	382	1.029	10:07 a. m.	26.2	126.6	378	375	1.036
10:40 a. m.	23.9	114.0	386	381	1.040	10:18 a. m.	26.9	126.5	374	378	1.036
1:28 p. m.	27.1	119.0	391	391	1.079	1:41 p. m.	29.5	126.0	377	376	1.037
1:36 p. m.	28.0	121.0	390	393	1.085	1:51 p. m.	29.5	126.0	374	373	1.032
2:06 p. m.	28.0	121.5	377	379	1.009	1:55 p. m.	30.1	126.1	370	374	1.021
2:17 p. m.	28.2	122.5	375	374	0.988	2:04 p. m.	29.5	125.9	369	373	1.016
Means					1.044						1.037

In Tables 8 and 9 are given the observations obtained at Asheville and Black Mountain, N. C., respectively. An effort was made to obtain nine complete observations each day at about hourly intervals, but until the new rheostat constructed by Professor Marvin was received on January 29, 1903, it was only possible to measure the radiation when the sunlight was sufficiently strong to cast a distinct shadow. After that date the radiation could be measured whenever the clouds were sufficiently thin to permit the sun's position to be determined.

At Asheville 84 observations on thirteen days were obtained in November; 83, on thirteen days in December; 129, on twenty days in January, and 52 observations on nine days during the first half of February. At Black Mountain 134 observations on twenty-one days were obtained between February 19 and March 26, inclusive.

The pyrheliometer was not in working order from December 1 to December 6, inclusive, so that, omitting Sundays and holidays, at Asheville 52 per cent of the possible nine observations per day were obtained during November; 46 per cent during December and 55 per cent during January, during which months observations were taken only when the sun was shining brightly enough to cast a distinct shadow. At Asheville, during the first half of February, 48 per cent, and at Black Mountain, between February 19 and March 26, 50 per cent of the possible observations were obtained, and they were taken whenever the position of the sun could be seen.

In Tables 8 and 9, column 1 gives the date and the seventy-fifth meridian time of the observations, the time being the mean of the time of beginning of exposure (1) and the ending of exposure (4) of the pyrheliometer bands. The hour angle in column 2 is obtained from column 1 by applying the equation of time and a correction for the number of degrees of longitude that the stations are west of the seventy-fifth meridian. The sun's altitude, in column 3, was computed for the Asheville observations, but for the Black Mountain observations it was obtained from the vertical circle readings of the polarimeter, which were checked each day at apparent noon by computation from the formula h = colatitude + sun's declination. A correction was also applied for the difference in time between the pyrheliometer and the polarimeter observations.

The number of atmospheres through which the solar rays had to pass, ε, of column 4, was obtained by interpolation in the tabulated values of Bouguer's formula given on page 22 of R. Radau's Actinométrie, Paris, 1877, the interpolation being facilitated by a table of cosecants of h for each degree; the interpolated values thus obtained were multiplied by the ratio of the actual barometric pressure, B, to the normal atmospheric pressure at sea level, 29.92 inches.

In column 5 Q' is the number of calories of heat received each minute upon a square centimeter of surface normal to the sun's rays, as measured by pyrheliometer No. 28. Dividing Q' by 0.92 to correct for the instrumental error of No. 28, we obtain Q in column 6.

The sling psychrometer, from which the air temperature t, of column 7, the relative humidity *R. H.*, of column 8, and the vapor pressure e, of column 9, were obtained, was whirled in the shade of a tree, and at Black Mountain, on the bank of a small stream. The barometric pressure B, of column 10, was read off from the Asheville barograph sheets, a correction being applied for the difference in level between the barograph and the pyrheliometer. Wind direction and velocity, recorded in columns 11 and 12, were taken from the Asheville record sheets. Under P, in column 13, is recorded the percentage of polarization of the sky light, as determined by the polarimeter observations, which were taken about ten minutes later than the pyrheliometer observation at Asheville, and about five minutes later at Black Mountain.

Under "Sky," in column 14, is recorded on scale 0–10, the blueness of the sky where the polarization was observed. Under "Mt." in column 15, is recorded on scale 0–10, the clearness with which distant mountains could be seen. At Asheville the mountains usually observed for this data were Pisgal and Cold Mountain, distant 17 and 20 miles southwest of the city, respectively, and their direction from the observing point explains why they were so much clearer in the morning than in the afternoon. At Black Mountain, peaks in several directions were observed, the most distant being Craggy Dome, seven miles to the northwest.

Under "Character of the sky," it must be understood that when "Light haze," "Dense Smoke," etc., is recorded "At sun," the same condition also applies to other parts of the sky. The

[5] See Monthly Weather Review for October, 1901, Vol. XXIX, pp. 457, 458.

TABLE 8.—*Pyrheliometer observations at Asheville, N. C. Latitude 35° 36′ north; longitude 82° 32′ west. Elevation above sea level, 2200 feet.*

Date and time (75th meridian time).	Hour angle.	h.	e.	Q′.	Q.	t.	R.H.	e.	B.	Wind.		P.	Sky.	Mt.	Character of sky.	
										Dir.	Vel.				At sun.	In general.
November 10.	°	°				°F.	%	*Inch.*	*Inches.*		*M. p. h.*	%				
10:06 a. m..	32.00	29.3	1.90	0.958	1.041	54	65	0.266	27.97	nw.	6	.....	7	.....	Light haze....	No clouds.
10:36 a. m .	24.50	32.5	1.75	0.983	1·068	58	62	0.298	27.97	nw.	7	.....	7	.....	....do	Few cirrus in southwest.
11:07 a. m..	16.75	35.1	1.62	1.022	1.111	61	56	0.298	27.96	nw.	8	.....	7	.....	....do	Do.
11:38 a. m..	9.00	36.7	1.56	1.010	1.098	64	45	0.266	27.95	nw.	12	.....	7	.....	....do	Do.
12:11 p. m..	0.75	37.4	1.53	0.996	1.083	66	39	0.256	27.93	nw.	7	.....	7	.....	....do	Do.
12:41 p. m..	6.75	37.0	1.55	1.034	1.124	68	42	0.287	27.91	nw.	7	.....	7	.....	....do	Do.
1:06 p. m..	13.00	35.9	1.58	1.039	1.129	68	37	0.277	27.90	nw.	10	.....	8	.....	....do	Do.
1:39 p. m..	21.25	33.5	1.69	0.936	1.017	68	37	0.261	27.89	nw.	12	.....	8	.....	....do	Do.
3:05 p. m..	42.75	23.6	2.31	0.867	0.942	69	34	0.247	27.88	nw.	8	.....	8	.....	....do	Do.
4:06 p. m..	58.00	14.0	3.77	0.658	0.715	67	43	0.287	27.89	nw.	8	.....	8	.....	....do	Do.
November 11.																
9:38 a. m..	39.00	25.4	2.16	0.406	0.441	53	82	0.334	28.04	sw.	2	.....	6	.....	Dense haze ...	3 alto-cumulus.
10:32 a. m..	25.50	31.7	1.78	0.620	0.674	59	68	0.347	28.04	sw.	1	.....	6	.....	....do	Few alto-cumulus.
11:03 a. m..	17.75	34.4	1.65	0.868	0.943	64	59	0.347	28.03	sw.	3	.....	6	.....	Light haze....	Few alto-cumulus in southwest.
11:32 a. m..	10.50	36.1	1.58	1.116	1.213	67	55	0.360	28.02	sw.	3	.....	7	.....	....do	Few alto-cumulus in southwest; few cumulus in east.
12:37 p. m..	5.75	36.7	1.56	1.072	1.165	72	42	0.316	28.00	s.	10	.....	7	.....	....do	Few cumulus on horizon.
1:35 p. m..	20.25	33.7	1.68	0.976	1.061	72	44	0.347	27.97	se.	12	.....	8	.....	....do	Few cumulus.
3:06 p. m..	43.00	23.1	2.36	0.878	0.954	71	43	0.322	27.95	se.	12	.....	8	.....	Clear	Few fracto-cumulus.
4:06 p. m..	58.00	13.8	3.84	0.698	0.759	70	40	0.287	27.95	se.	12	.....	8	.....	....do	Few cumulus in east.
4:35 p. m..	65.25	8.5	6.00	0.476	0.517	68	43	0.298	27.95	s.	10	.....	8	.....	....do	Few cirrus; few cumulus.
November 12.																
9:20 a. m..	43.50	22.8	2.40	0.822	0.893	50	73	0.256	28.03	s.	2	.....	7	.....	Light haze....	Dense haze near station.
9:37 a. m..	39.25	25.1	2.19	0.818	0.889	53	66	0.277	28.03	s.	3	.....	7	.....	....do	Do.
10:13 a. m..	30.25	29.6	1.88	0·942	1.024	58	62	0.287	28.03	s.	3	.....	7	.....	....do	Do.
10:33 a. m..	25.25	31.6	1.78	0.993	1.079	62	52	0.287	28.03	s.	4	.....	8	.....	....do	No clouds.
11:07 a. m..	16.75	34.4	1.65	1.042	1.133	66	42	0.266	28.02	s.	8	.....	8	.....	....do	Few cirrus in east.
11:34 a. m..	10.00	35.9	1.59	1.108	1.204	66	42	0.266	28.01	s.	7	.....	8	.....	....do	No clouds.
12:35 p. m..	5.25	36.5	1.57	1.088	1.183	70	33	0.247	27.99	s.	6	.....	8	.....	....do	Do.
1:40 p. m..	21.50	33.0	1.71	1.004	1.091	72	32	0.247	27.95	se.	6	.....	8	.....	....do	Do.
3:06 p. m..	43.00	23.1	2.36	0.951	1.034	71	31	0.237	27.92	se.	8	.....	8	.....	....do	Do.
4:04 p. m..	57.50	14.0	3.78	0.726	0.789	68	38	0.261	27.92	s.	12	.....	7	.....	....do	Few cirrus in northwest.
4:33 p. m..	64.75	8.7	5.86	0.512	0.557	67	39	0.256	27.92	s.	12	.....	7	.....	....do	Do.
November 13.																
9:03 a. m..	47.75	20.0	2.72	0.526	0.572	44	84	0.247	28.06	sw.	2	.....	6	.....	Dense smoke..	No clouds.
9:31 a. m..	40.75	24.0	2.29	0.532	0.578	49	76	0.247	28.06	sw.	2	.....	6	.....	....do	Do.
10:34 a. m..	25.00	31.5	1.79	0.726	0.789	57	62	0.287	28.06	sw.	2	.....	7	.....	....do	Do.
11:32 a. m..	10.50	35.6	1.60	0.820	0.891	64	53	0.310	28.04	sw.	3	.....	7	.....	....do	Few cumulo-stratus in south.
12:35 p. m..	5.25	36.3	1.58	0.852	0.926	67	49	0.322	28.03	se.	3	.....	7	.....	Light haze....	Do.
1:34 p. m..	20.00	33.2	1.70	1.036	1.126	70	45	0.322	27.99	s.	4	.....	8	.....	....do	Do.
3:03 p. m..	42.25	23.0	2.37	0.918	0.998	70	47	0.347	27.95	s.	10	.....	8	.....	....do	Do.
4:05 p. m..	57.75	13.5	3.90	0.618	0.672	69	52	0.373	27.94	se.	12	.....	8	.....	....do	Few cumulo-stratus in southwest.
4:36 p. m..	65.50	8.0	6.30	0.397	0.432	.....	.....	.....	27.94	se.	10	.....	8	.....	....do	Few cumulo-stratus in east.
November 14.																
10:47 a. m..	21.75	32.5	1.73	0.764	0.830	65	73	0.448	27.99	ne.	3	.....	6	.....	....do	1 cumulo-stratus.
12:12 p. m..	0.75	36.3	1.58	0.986	1.072	69	68	0.482	27.97	se.	10	.....	8	.....	....do	3 cumulo-stratus.
12:31 p. m..	4.25	36.1	1.58	1.014	1.102	68	62	0.417	27.94	se.	10	.....	8	.....	....do	Do.
1:47 p. m..	23.25	32.0	1.75	0.942	1.024	68	54	0.373	27.91	se.	13	.....	8	.....	Clear	4 cumulo-stratus.
3:06 p. m..	43.00	22.5	2.42	0.790	0.859	70	53	0.387	27.89	se.	15	.....	8	.....	....do	3 cumulus.
4:04 p. m..	57.50	13.5	3.91	0.527	0.573	66	62	0.402	27.89	se.	15	.....	8	.....	Partly cloudy.	4 cumulo-stratus.
4:35 p. m..	65.25	8.1	6.22	0.343	0.373	65	62	0.402	27.89	se.	15	.....	8	.....	....do	1 cumulo-stratus.
November 15.																
9:13 a. m..	45.50	20.9	2.59	0.438	0.476	49	93	0.322	27.90	calm.	0	.....	6	.....	Dense smoke..	Dense fog, dissipating.
9:35 a. m..	40.00	24.1	2.26	0.626	0.680	52	88	0.334	27.90	calm.	0	.....	6	.....	....do	No clouds.
10:35 a. m..	25.00	31.0	1.80	0.682	0.741	60	76	0.402	27.90	s.	2	.....	6	.....	....do	Do.
11:36 a. m..	9.75	35.3	1.61	0.867	0.942	65	59	0.373	27.90	sw.	3	.....	6	.....	Light haze....	Few cumulo-stratus in south.
12:37 p. m..	5.50	35.7	1.59	0.894	0.972	69	50	0.360	27.88	n.	6	.....	7	.....	....do	Few cumulus in south and west.
1:38 p. m..	20.75	32.5	1.72	0.992	1.078	71	50	0.373	27.84	nw.	8	.....	8	.....	....do	Do.
3:05 p. m..	42.75	22.5	2.42	0.870	0.946	72	50	0.402	27.82	nw.	8	.....	8	.....	....do	Few cumulus on horizon.
4:06 p. m..	57.75	13.2	3.98	0.660	0.717	72	53	0.402	27.81	nw.	3	.....	8	.....	....do	Do.
4:35 p. m..	64.75	8.3	6.08	0.421	0.458	70	52	0.387	27.81	nw.	4	.....	7	.....	....do	Do.
November 18.																
11:18 a. m..	14.25	33.6	1.67	0.720	0.783	57	81	0.373	27.76	nw.	14	.....	8	.....	Partly cloudy.	6 cumulo-stratus.
11:39 a. m..	9.00	34.6	1.63	0.940	1.022	59	78	0.378	27.76	nw.	15	.....	8	.....	Clear	4 cumulo-stratus.
12:38 p. m..	5.75	34.9	1.61	0.945	1.027	58	78	0.373	27.76	nw.	15	.....	8	.....	....do	Do.
1:35 p. m..	20.00	32.0	1.74	0.990	1.076	58	76	0.360	27.73	n.	15	.....	8	.....	....do	Few cumulus; few cumulo-stratus.
3:08 p. m..	43.25	21.6	2.51	0.824	0.896	59	71	0.360	27.75	nw.	10	.....	8	.....	....do	Few cumulo-stratus on horizon.
4:07 p. m..	58.00	12.6	4.16	0.668	0.726	57	74	0.347	27.75	nw.	8	.....	7	.....	....do	Do.
4:32 p. m..	64.25	8.1	6.20	0.601	0.653	55	78	0.360	27.75	nw.	8	.....	6	.....	....do	Do.
November 19.																
11:42 a. m..	8.24	34.5	1.64	0.842	0.915	56	81	0.360	27.88	sw.	6	.....	6	.....	Partly cloudy.	3 cirro-stratus; 2 alto-cumulus.
3:10 p. m..	43.75	21.1	2.57	0.610	0.663	61	59	0.322	27.84	e.	7	.....	5	.....	....do	5 cirro-stratus; 3 cumulo-stratus.
November 20.																
4:34 p. m..	64.50	7.7	6.55	0.438	0.476	53	83	0.334	27.95	se.	10	.....	6	.....	....do	2 cirrus; 1 cumulo-stratus.
November 21.																
9:37 a. m..	39.75	23.0	2.37	0.758	0.824	56	70	0.316	27.92	nw.	8	.....	6	.....	....do	5 alto-cumulus.
10:09 a. m..	31.75	26.9	2.05	0.948	1.030	58	60	0.282	27.92	nw.	8	.....	6	.....	Light haze ...	1 fracto-cumulus.
10:43 a. m..	23.25	30.4	1.84	0.876	0.952	59	56	0.277	27.92	nw.	9	.....	6	.....	Partly cloudy.	Few cirrus; few fracto-cumulus.
11:39 a. m..	9.25	33.9	1.67	0.740	0.804	60	57	0.298	27.91	nw.	9	.....	5	.....	Cloudy	10 cirro-stratus; solar halo, 22° radius.
12:37 p. m..	5.25	34.3	1.65	0.510	0.554	61	55	0.298	27.89	nw.	7	.....	5	.....	....do	Do.
1:38 p. m..	20.50	31.3	1.79	0.504	0.548	63	53	0.298	27.86	nw.	9	.....	4	.....	....do	10 cirro-stratus.
3:08 p. m..	43.00	21.2	2.56	0.330	0.359	62	54	0.298	27.84	nw.	7	.....	4	.....	....do	Do.
November 26.																
11:39 a. m..	9.50	32.8	1.68	0.899	0.977	58	68	0.322	27.26	w.	3	.....	8	.....	Partly cloudy.	2 cumulus.
1:14 p. m..	14.25	32.0	1.71	0.876	0.952	61	61	0.322	27.21	nw.	4	.....	8	.....	Clear	4 cumulus.
November 28.																
10:12 a. m..	31.50	25.8	2.13	0.730	0.793	34	73	0.143	27.92	nw.	15	.....	3	.....	Partly cloudy.	3 cirro-stratus; few cumulo-stratus.
10:43 a. m..	23.75	28.9	1.92	0.226	0.246	35	69	0.143	27.92	nw.	12	.....	2	.....	Cloudy	10 cirro-stratus; solar halo, 22° radius.
11:42 a. m..	9.00	32.5	1.73	0.816	0.887	38	66	0.150	27.93	nw.	8	.....	4	.....	....do	10 cirrus, in bands.
12:36 p. m..	4.50	33.0	1.71	0.822	0.893	40	61	0.143	27.91	nw.	4	.....	5	.....	....do	10 cirrus.
1:40 p. m..	20.50	29.9	1.86	0.469	0.510	42	51	0.136	27.90	n.	4	.....	5	.....	....do	10 cirro-stratus.
3:08 p. m..	42.50	20.3	2.67	0.604	0.657	46	41	0.124	27.89	s.	2	.....	6	.....	....do	7 cirrus.
4:06 p. m..	57.00	11.7	4.47	0.538	0.585	45	41	0.124	27.88	s.	4	.....	6	.....	Partly cloudy.	Few cirro-stratus near sun.
4:32 p. m..	63.50	7.5	6.66	*0.235	0.255	44	45	0.130	27.88	se.	6	.....	6	.....	....do	Few cirro-stratus in southwest.
November 29.																
†9:14 a. m..	46.00	18.1	2.99	0.609	0.662	39	73	0.172	28.04	s.	12	.....	7	.....	Light smoke..	Few cirrus in southwest.
†9:43 a. m..	38.75	22.1	2.47	0.670	0.728	42	58	0.150	28.04	se.	12	.....	6	.....	....do	1 cirro-stratus; few alto-stratus.
December 8.																
10:34 a. m..	27.00	26.4	2.10	0.758	0.824	33	59	0.108	28.00	nw.	30	44.8	7	8	Light smoke..	Few fracto-cumulus.
11:31 a. m..	12.75	30.5	1.83	0.755	0.821	34	49	0.108	27.99	nw.	30	45.4	7	8	....do	Few cirrus in west.
12:35 p. m..	3.25	31.6	1.78	0.924	1.004	36	51	0.103	27.97	nw.	25	46.0	7	7	....do	1 cirrus near sun.
1:43 p. m..	20.25	28.7	1.93	0.818	0.889	36	49	0.103	27.96	nw.	25	46.0	6	5	....do	Few cirrus.
3:07 p. m..	41.25	19.8	2.74	0.574	0.624	34	46	0.093	27.95	nw.	25	38.2	5	4	....do	Do.
4:06 p. m..	56.00	11.3	4.63	0.348	0.378	32	43	0.077	27.95	nw.	23	40.0	5	5	Partly cloudy.	1 cirrus near sun.
4:31 p. m..	62.25	7.2	6.89	0.259	0.282	32	45	0.077	27.95	nw.	24	36.3	5	5	....do	Few cirrus near sun.

TABLE 8.—*Pyrheliometer observations at Asheville, N. C.*—Continued.

Date and time (75th meridian time).	Hour angle.	*h.*	*e.*	*Q'.*	*Q.*	*t.*	*R. H.*	*e.*	*B.*	Wind.		*P.*	Sky.	Mt.	Character of sky.	
										Dir.	Vel.				At sun.	In general.
December 9.‡	°	°				°F.	%	*Inch.*	*Inches.*		*M. p. h.*	%				
9:22 a. m.	45.00	17.8	3.04	0.505	0.549	28	66	0.103	28.04	nw.	10	50.5	6	8	Light smoke..	Few cirro-stratus in southwest.
9:40 a. m.	40.50	20.2	2.69	0.552	0.600	30	53	0.089	28.05	nw.	12	48.5	5	8	....do	Few cirrus in southwest.
10:47 a. m.	24.75	27.1	2.04	0.730	0.793	35	48	0.098	28.05	nw.	9	48.6	4	7	....do	1 cirrus well distributed.
11:39 a. m.	10.75	30.7	1.83	0.759	0.825	38	44	0.098	28.04	n.	9	47.0	6	6	....do	2 cirrus in north.
12:43 p. m.	5.25	31.4	1.79	0.686	0.746	41	37	0.093	28.00	n.	12	50.4	6	6	....do	Few cirrus in south.
1:33 p. m.	17.75	29.3	1.90	0.766	0.833	41	34	0.089	27.96	n.	10	53.6	6	4	....do	Few cirrus in southwest.
3:05 p. m.	40.75	20.1	2.58	0.626	0.680	43	36	0.093	27.95	nw.	4	51.6	7	5	....do	Do.
4:02 p. m.	55.00	11.8	4.46	0.480	0.522	42	39	0.103	27.96	nw.	4	47.0	6	4	Partly cloudy.	Fine cirrus over most of sky.
4:31 p. m.	62.25	7.1	6.98	0.274	0.298	40	39	0.093	27.97	nw.	4	42.6	3	4	....do	Do.
December 10.																
11:09 a. m.	18.50	29.0	1.92	0.717	0.779	41	61	0.157	28.06	sw.	5	50.4	7	5	Light smoke..	Few cumulo-stratus.
11:39 a. m.	11.00	30.6	1.84	0.778	0.846	44	52	0.150	28.05	s.	4	49.6	7	5	....do	Do.
12:34 p. m.	2.75	31.4	1.79	0.924	1.043	49	45	0.157	28.03	sw.	4	48.6	6	5	....do	Do.
1:34 p. m.	17.75	29.1	1.91	0.770	0.837	52	44	0.164	27.96	sw.	3	48.1	6	5	....do	Few cirrus; few cumulo-stratus.
3:03 p. m.	40.00	19.0	2.84	0.468	0.509	54	46	0.203	27.93	nw.	4	42.6	6	3	Partly cloudy.	3 cirrus; 2 alto-cumulus.
4:05 p. m.	55.50	11.4	4.59	0.232	0.252	51	51	0.187	27.93	nw.	4	29.5	4	1	Cloudy	Sky nearly overcast with cirrus and cirro-stratus.
December 11.																
9:34 a. m.	42.25	18.9	2.86	0.272	0.296	46	73	0.228	27.94	n.	2	49.1	3	0	Dense smoke..	No clouds visible.
10:34 a. m.	27.25	26.1	2.11	0.525	0.571	54	61	0.256	27.94	sw.	1	46.8	5	0	....do	Do.
11:33 a. m.	12.50	30.2	1.85	0.789	0.858	60	56	0.287	27.91	n.	4	50.9	4	1	Light smoke..	Few cirrus near horizon.
12:34 p. m.	2.75	31.3	1.79	0.572	0.622	62	51	0.277	27.87	n.	3	47.6	5	2	Partly cloudy.	5 cirrus.
1:33 p. m.	17.50	29.1	1.91	0.690	0.750	64	51	0.298	27.83	s.	4	35.4	4	3	....do	6 cirrus.
3:18 p. m.	43.75	18.3	2.94	0.514	0.559	64	42	0.247	27.80	sw.	8	23.2	3	4	Cloudy	10 cirrus; few cumulus.
4:03 p. m.	55.00	11.7	4.46	0.387	0.421	63	43	0.256	27.79	w.	5	22.8	1	4	....do	Do.
4:33 p. m.	62.50	6.9	7.12	0.282	0.307	62	44	0.247	27.78	w.	3	45.8	3	4	....do	6 cirrus.
December 13.																
3:11 p. m.	41.75	19.6	2.73	0.702	0.763	64	55	0.334	27.55	nw.	20	47.1	4	4	Partly cloudy.	2 cumulus; many fine cirrus.
4:05 p. m.	55.25	11.4	4.53	0.422	0.459	60	66	0.334	27.58	nw.	15	50.6	5	4	....do	Few cirrus; few cumulus.
4:35 p. m.	62.75	6.5	7.48	0.222	0.241	58	70	0.322	27.60	nw.	15	46.2	4	3	....do	Few cirrus; few fracto-cumulus.
December 16.																
3:07 p. m.	40.50	19.7	2.73	0.828	0.900	49	69	0.237	27.72	nw.	24	53.8	8	3	Clear	1 cumulo-stratus.
4:03 p. m.	54.75	11.6	4.49	0.676	0.735	49	63	0.219	27.73	nw.	18	51.8	7	3	Light smoke..	Few fracto-cumulus.
4:34 p. m.	62.25	6.7	7.31	0.416	0.452	47	59	0.187	27.73	nw.	16	46.5	6	3	....do	Few fracto-cumulus in south.
December 17.																
9:38 a. m.	42.00	18.8	2.87	0.714	0.776	.....	.....	.....	27.90	nw.	33	48.8	7	10	....do	No clouds.
10:39 a. m.	26.75	25.9	2.12	0.812	0.883	39	48	0.113	27.93	nw.	32	50.9	7	10	....do	Do.
11:40 a. m.	11.50	30.0	1.85	0.869	0.945	40	44	0.113	27.91	nw.	28	51.8	7	9	....do	Do.
12:38 p. m.	3.00	31.0	1.80	0.938	1.020	42	45	0.118	27.90	nw.	25	52.6	8	8	....do	Do.
1:35 p. m.	17.25	29.0	1.91	0.946	1.028	45	42	0.124	27.89	nw.	22	51.5	8	5	....do	Few cirrus in west.
3:08 p. m.	40.50	19.7	2.74	0.794	0.863	46	38	0.113	27.87	nw.	16	48.1	6	4	....do	1 cirrus well distributed.
4:05 p. m.	54.75	11.6	4.51	0.474	0.515	44	41	0.113	27.86	nw.	15	44.4	6	3	....do	Few cirrus in southeast.
4:34 p. m.	62.00	6.9	6.94	0.302	0.328	43	40	0.108	27.86	nw.	14	39.8	6	2	....do	Do.
December 18.																
9:45 a. m.	40.25	19.7	2.74	0.678	0.737	41	42	0.108	27.85	nw.	27	51.4	8	10	....do	No clouds.
10:48 a. m.	24.50	26.6	2.07	0.796	0.865	43	35	0.098	27.86	nw.	23	52.4	8	10	....do	Do.
11:38 a. m.	12.00	29.9	1.86	0.862	0.937	46	35	0.113	27.86	nw.	19	50.2	8	9	....do	Do.
12:38 p. m.	3.00	30.9	1.81	0.814	0.885	47	32	0.103	27.85	nw.	20	51.4	7	8	....do	Do.
1:42 p. m.	19.00	28.3	1.95	0.832	0.904	49	29	0.113	27.83	nw.	23	50.3	8	6	....do	Do.
3:05 p. m.	39.75	20.1	2.69	0.784	0.852	50	28	0.093	27.82	nw.	22	49.6	7	4	....do	Do.
4:07 p. m.	55.25	11.2	4.65	0.468	0.509	48	29	0.098	27.83	nw.	19	45.8	7	3	....do	Do.
4:35 p. m.	62.25	6.7	7.34	0.347	0.377	46	32	0.103	27.83	nw.	16	40.0	6	3	....do	Do.
December 19.																
9:09 a. m.	49.50	14.7	3.62	0.158	0.172	30	83	0.136	27.89	sw.	1	45.4	3	2	Dense smoke..	Do.
9:37 a. m.	42.50	18.6	2.90	0.254	0.276	33	73	0.136	27.89	sw.	1	44.5	5	1	....do	Do.
10:36 a. m.	27.75	25.4	2.16	0.796	0.865	42	51	0.136	27.89	sw.	2	34.3	4	5	Light smoke..	6 cirro-stratus.
11:36 a. m.	12.75	29.7	1.87	0.730	0.793	50	40	0.150	27.88	sw.	4	27.4	3	5	Cloudy	Fine cirro-stratus over most of sky; solar halo, 22° radius.
12:34 p. m.	1.75	30.9	1.80	0.413	0.449	56	35	0.157	27.84	s.	4	20.9	2	4	....do	10 cirro-stratus; solar halo, 22° radius.
1:33 p. m.	16.50	29.0	1.90	0.488	0.530	59	30	0.143	27.81	s.	6	13.8	1	5	....do	Do.
3:02 p. m.	38.75	20.6	2.62	*0.132	0.143	59	30	0.150	27.79	sw.	4	14.4	1	4	....do	Do.
December 22.																
12:49 p. m.	5.25	30.7	1.81	0.725	0.788	41	66	0.172	27.73	nw.	18	40.6	5	3	Light haze....	1 cirrus; 1 cumulo-stratus.
1:37 p. m.	17.25	28.7	1.92	0.724	0.787	41	66	0.172	27.72	nw.	16	39.4	6	2	....do	Do.
4:07 p. m.	54.25	11.7	4.45	0.318	0.346	39	70	0.164	27.76	nw.	20	3.0	0	0	....do	9 cumulo-stratus.
December 23.																
11:56 a. m.	8.25	30.4	1.83	0.776	0.843	42	77	0.211	27.88	nw.	14	17.1	6	1	Partly cloudy.	1 cirrus; 7 cumulo-stratus.
12:50 p. m.	5.25	30.7	1.82	0.737	0.801	43	72	0.187	27.86	nw.	16	36.8	7	1	....do	Few cirrus; 6 cumulo-stratus.
1:35 p. m.	16.50	28.9	1.92	0.704	0.765	42	69	0.187	27.86	nw.	16	39.6	7	1	Light haze....	Few cirrus; 2 cumulo-stratus.
3:04 p. m.	38.75	20.5	2.63	0.606	0.659	42	68	0.187	27.87	nw.	16	44.2	8	2	....do	Few fracto-cumulus.
4:04 p. m.	53.75	12.1	4.32	0.411	0.447	41	67	0.172	27.88	nw.	16	42.0	7	3	....do	Do.
4:33 p. m.	61.00	7.4	6.70	0.269	0.292	40	67	0.164	27.88	nw.	10	36.1	5	2	....do	Do.
December 30.																
9:08 a. m.	51.00	13.9	3.81	0.602	0.654	34	48	0.093	27.96	nw.	15	55.2	8	10	Light smoke ..	No clouds.
10:03 a. m.	37.25	21.4	2.54	0.667	0.725	38	38	0.085	27.97	nw.	15	55.7	9	10	....do	Few cirro-stratus in west.
10:38 a. m.	28.50	25.3	2.18	0.785	0.853	38	36	0.081	27.98	nw.	15	55.4	8	9	....do	Do.
11:40 a. m.	13.00	29.9	1.87	0.738	0.802	40	40	0.098	27.98	nw.	20	55.6	8	8	Partly cloudy.	6 cirrus.
12:45 p. m.	3.00	31.1	1.80	0.912	0.991	42	39	0.103	27.98	nw.	15	18.4	1	8	Light smoke..	5 cirrus.
1:38 p. m.	16.50	29.1	1.91	0.867	0.942	44	42	0.118	27.95	nw.	15	54.8	9	6	....do	1 cirrus.
3:06 p. m.	38.50	20.8	2.77	0.852	0.926	42	40	0.108	27.95	nw.	15	54.9	9	4	....do	Do.
4:05 p. m.	53.25	12.4	4.24	0.517	0.562	41	39	0.098	27.95	nw.	10	39.2	4	3	Partly cloudy.	Few cirrus; 1 cirro-stratus.
December 31.																
9:41 a. m.	43.00	18.4	2.94	0.239	0.260	33	70	0.130	28.02	sw.	2	40.8	3	1	Cloudy	Fine cirrus over most of sky.
10:36 a. m.	29.25	25.1	2.19	0.716	0.778	39	50	0.118	28.05	s.	4	45.6	3	2	....do	Do.
11:37 a. m.	6.50	30.9	1.82	0.794	0.863	44	48	0.136	28.03	s.	3	45.1	5	5	Partly cloudy.	3 cirrus.
12:45 p. m.	3.00	31.2	1.80	0.870	0.946	49	31	0.108	28.00	s.	4	49.6	8	4	Light haze....	1 cirrus in southeast.
1:35 p. m.	15.50	29.4	1.90	0.797	0.866	50	32	0.113	27.97	sw.	4	49.0	8	4	....do	No clouds.
3:06 p. m.	38.25	21.0	2.59	0.644	0.700	51	33	0.124	27.95	sw.	3	49.4	8	3	....do	Few cirrus in south.
4:05 p. m.	53.00	12.8	4.11	0.498	0.541	50	32	0.118	27.95	sw.	4	46.8	7	3	....do	Do.
January 3.																
1:05 p. m.	8.00	31.0	1.77	*0.737	0.801	45	72	0.219	27.51	n.	24	7.2	0	6	Partly cloudy.	1 cirrus; 8 cumulo-stratus.
January 5.																
10:57 a. m.	24.50	27.2	2.00	0.689	0.749	41	70	0.180	27.53	s.	12	18.2	9	6	....do	1 alto-cumulus; 3 cumulo-stratus.
11:46 a. m.	12.25	30.6	1.80	0.734	0.798	40	68	0.164	27.51	se.	12	5.8	9	5	....do	4 cumulo-stratus.
12:36 p. m.	0.25	31.7	1.74	0.740	0.804	42	64	0.172	27.47	se.	10	26.2	6	2	....do	1 cirro-cumulus; 3 cumulo-stratus.
January 6.																
9:36 a. m.	45.00	17.9	2.96	0.366	0.398	27	73	0.108	27.54	nw.	24	30.3	6	0	....do	4 cumulo-stratus.
10:59 a. m.	24.25	27.4	1.99	0.413	0.449	29	70	0.108	27.55	nw.	20	0.0	0	0	....do	4 cumulo-stratus; light snow falling.
1:50 p. m.	18.50	29.2	1.88	0.505	0.549	28	76	0.113	27.52	nw.	15	29.6	5	1	....do	5 cumulo-stratus; light snow falling.
3:08 p. m.	38.00	21.8	2.46	0.414	0.450	30	68	0.108	27.53	nw.	24	30.8	8	1	Light haze....	1 cumulo-stratus.
4:03 p. m.	54.75	12.1	4.27	0.340	0.370	27	67	0.093	27.55	n.	15	27.2	5	2	....do	2 cumulo-stratus.
January 7.																
9:38 a. m.	44.50	18.3	2.88	0.260	0.283	38	67	0.157	27.25	se	4	12.4	1	2	Cloudy	10 cirro-stratus.
10:37 a. m.	29.75	25.5	2.10	0.458	0.498	43	54	0.150	27.25	sw.	7	38.0	7	8	....do	1 cirro-stratus; few cumulo-stratus; many fine cirrus.
11:36 a. m.	15.00	30.2	1.80	0.648	0.704	43	50	0.136	27.21	sw.	24	39.3	7	8	Partly cloudy.	4 cirro-stratus; few cumulo-stratus.

TABLE 8.—*Pyrheliometer observations at Asheville, N. C.*—Continued.

Date and time (75th meridian time).	Hour angle.	h.	e.	Q'.	Q.	t.	R. H.	e.	B.	Wind.		P.	Sky.	Mt.	Character of sky.	
										Dir.	Vel.				At sun.	In general.
Jan. 7—*Cont'd.*	°	°				°F.	%.	*Inch.*	*Inches.*		*M. p. h.*	%.				
12:35 p. m..	0.25	31.9	1.71	0.756	0.822	43	48	0.130	27.18	sw.	22	40.4	7	7	Light haze....	Few cirro-stratus; few fracto-cumulus.
1:36 p. m..	15.00	30.2	1.80	0.764	0.830	45	47	0.143	27.16	sw.	24	39.3	7	5	....do	Few cumulo-stratus; few fracto-cumulus.
3:15 p. m..	32.25	24.5	2.18	0.154	0.167	42	54	0.150	27.17	sw.	20	5.8	0	0	Cloudy	6 alto-stratus; 4 cumulo-stratus.
January 8.																
12:34 p. m..	0.50	32.0	1.73	0.728	0.791	23	66	0.077	27.49	nw.	15	32.3	9	8	Light haze....	1 cumulo-stratus.
1:34 p. m..	14.50	30.5	1.80	0.748	0.813	23	76	0.089	27.46	nw.	20	22.2	8	5	....do	Do.
3:07 p. m..	37.75	22.0	2.46	0.610	0.663	23	64	0.077	27.46	nw.	20	37.8	8	4	....do	Do.
4:07 p. m..	52.75	13.6	3.82	0.348	0.378	22	64	0.074	27.46	nw.	22	38.5	8	4	....do	Few cumulo-stratus.
4:35 p. m..	59.75	9.1	5.54	0.258	0.280	22	58	0.070	27.47	nw.	23	35.5	6	3	....do	1 cumulo-stratus.
January 9.																
9:10 a. m..	51.75	14.3	3.68	0.410	0.446	20	62	0.063	27.68	n.	15	42.4	9	10	Light smoke..	Few cirrus in southwest.
9:39 a. m..	44.50	18.5	2.89	0.525	0.571	21	56	0.063	27.68	n.	15	44.0	9	10	....do	Do.
10:34 a. m..	30.75	25.3	2.16	0.680	0.739	25	59	0.081	27.67	nw.	12	43.7	9	10	....do	Few cirrus in south.
11:40 a. m..	14.25	30.6	1.81	0.668	0.726	27	60	0.085	27.65	n.	13	44.5	9	10	....do	Do.
12:40 p. m..	0.75	32.2	1.72	0.708	0.770	31	55	0.093	27.60	n.	20	45.2	9	8	....do	Few cirrus; few cumulo-stratus in south.
1:35 p. m..	14.50	30.6	1.81	0.761	0.827	34	47	0.093	27.57	n.	15	47.2	9	6	....do	Few cumulo-stratus in south.
3:06 p. m..	37.25	22.3	2.41	0.745	0.810	35	32	0.063	27.56	n.	15	49.8	9	4	....do	Few cirrus and few cumulo-stratus in south.
4:06 p. m..	52.25	14.0	3.73	0.483	0.525	36	35	0.070	27.56	n.	9	48.2	8	3	....do	Few cirrus in south.
4:35 p. m..	59.50	9.3	5.46	0.365	0.397	35	32	0.063	27.56	n.	9	45.4	8	3	....do	Do.
January 10.																
10:47 a. m..	27.50	26.7	2.05	0.274	0.298	32	41	0.077	27.81	nw.	9	32.7	8	9	Partly cloudy.	4 cirrus; 4 alto-stratus.
11:35 a. m..	15.50	30.5	1.82	0.772	0.839	35	41	0.081	27.80	nw.	10	44.2	8	9	Light smoke..	1 cirrus on horizon.
12:34 p. m..	0.75	32.3	1.73	0.790	0.859	36	42	0.089	27.78	nw.	9	36.3	5	7	Light haze....	2 cirrus.
1:36 p. m..	14.75	30.7	1.81	0.374	0.407	40	40	0.098	27.76	nw.	6	3.3	1	7	Partly cloudy.	4 cirrus; 4 alto-cumulus.
3:03 p. m..	36.50	22.8	2.37	0.566	0.615	40	38	0.093	27.72	sw.	3	43.8	8	4	Light haze....	3 alto-cumulus.
4:04 p. m..	51.75	14.4	3.66	0.377	0.410	41	36	0.093	27.71	sw.	2	41.0	5	1	....do	Few cirrus; 1 alto-stratus in west.
January 12.																
9:11 a. m..	51.75	14.6	3.62	0.454	0.493	15	72	0.057	27.80	nw.	22	47.7	8	10	Clear	Few cumulo-stratus.
9:46 a. m..	43.00	19.6	2.75	0.542	0.589	16	68	0.057	27.82	nw.	20	46.9	8	10	Light smoke..	Do.
10:35 a. m..	30.75	25.7	2.13	0.766	0.833	19	67	0.066	27.83	nw.	22	47.8	8	10	....do	Do.
11:38 a. m..	15.00	30.9	1.80	0.821	0.892	21	63	0.066	27.83	nw.	21	48.0	8	9	....do	Few fracto-cumulus.
12:36 p. m..	0.50	32.6	1.72	0.826	0.898	22	64	0.070	27.82	nw.	20	46.4	8	9	....do	Do.
1:34 p. m..	14.00	31.1	1.79	0.784	0.852	23	62	0.074	27.82	nw.	16	46.0	8	6	....do	Few cumulo-stratus on horizon.
3:09 p. m..	37.25	22.6	2.40	0.592	0.643	22	61	0.070	27.82	nw.	24	42.4	7	4	....do	Do.
4:05 p. m..	51.75	14.6	3.63	0.475	0.516	29	58	0.062	27.84	nw.	15	39.7	7	3	....do	Few cumulo-stratus in east.
4:36 p. m..	58.50	9.6	5.37	0.296	0.322	19	57	0.057	27.85	nw.	12	35.0	7	3	....do	Few cumulo-stratus in west.
January 13.																
9:10 a. m..	52.25	14.4	3.70	0.382	0.415	16	68	0.057	28.03	nw.	10	49.3	9	10	....do	Few alto-stratus in south.
9:45 a. m..	43.50	19.5	2.78	0.644	0.700	18	56	0.057	28.03	nw.	11	51.2	9	10	....do	Do.
10:34 a. m..	31.25	25.5	2.16	0.794	0.863	20	55	0.057	28.02	nw.	12	51.8	9	10	....do	Few alto-stratus in southwest.
11:44 a. m..	13.75	31.4	1.79	0.762	0.828	26	43	0.060	28.01	nw.	12	51.2	9	9	....do	1 cirrus near sun.
12:36 p. m..	0.75	32.8	1.72	0.770	0.837	28	45	0.070	28.00	nw.	12	51.8	9	7	....do	Do.
1:36 p. m..	13.25	31.3	1.80	0.704	0.765	31	50	0.085	27.98	nw.	10	49.6	8	5	Partly cloudy.	6 cirrus.
3:05 p. m..	36.50	23.1	2.36	0.688	0.748	33	37	0.066	27.96	nw.	6	49.2	8	4	Light smoke..	Few cirrus on horizon.
4:05 p. m..	51.50	14.8	3.58	0.556	0.604	32	38	0.066	27.96	nw.	7	45.4	8	4	..do	Few cirrus in south.
4:34 p. m..	58.75	10.2	5.10	0.388	0.422	31	31	0.052	27.96	nw.	8	42.9	7	3	....do	No clouds.
January 15.																
9:09 a. m..	52.50	14.5	3.70	0.206	0.224	31	70	0.118	27.88	nw.	3	40.0	6	7	Partly cloudy.	2 cirrus.
9:38 a. m..	45.25	18.9	2.85	0.340	0.370	33	63	0.118	27.88	nw.	6	43.1	7	7	....do	Do.
10:35 a. m ..	31.00	26.0	2.11	0.532	0.578	39	57	0.136	27.88	nw.	7	44.1	7	8	....do	5 cirrus.
11:38 a. m..	15.25	31.3	1.79	0.814	0.885	43	50	0.143	27.86	nw.	7	45.8	7	8	Light smoke..	1 cirrus in southeast.
12:34 p. m..	1.25	33.1	1.69	0.811	0.882	43	51	0.143	27.86	nw.	14	46.2	7	7	....do	Few cirrus on horizon.
1:34 p. m ..	13.75	31.7	1.77	0.822	0.893	46	48	0.143	27.84	nw.	12	46.2	7	5	....do	No clouds.
3:08 p. m..	37.25	23.1	2.35	0.642	0.698	46	45	0.136	27.82	n.	20	45.2	7	4	Dense smoke..	Do.
4:04 p. m..	51.25	15.3	3.47	0.518	0.563	44	45	0.130	27.81	n.	18	42.0	7	3	Light smoke..	Do.
4:34 p. m..	58.75	10.5	4.94	0.379	0.412	43	45	0.124	27.81	n.	20	38.6	6	3	....do	Do.
January 16.																
9:10 a. m..	52.50	14.6	3.63	0.116	0.126	32	77	0.136	27.83	n.	3	17.4	2	1	Cloudy	10 cirrus.
9:38 a. m..	45.50	19.0	2.83	*0.107	0.116	34	85	0.164	27.85	n.	2	6.3	1	4	....do	Do.
1:33 p. m..	13.25	32.0	1.74	0.546	0.593	47	51	0.164	27.77	nw.	3	16.0	3	4	....do	9 cirrus; 1 alto-cumulus.
January 17.																
10:41 a. m..	29.75	26.9	2.03	0.647	0.703	46	54	0.164	27.61	nw.	15	42.8	6	8	Partly cloudy.	9 alto-stratus.
11:39 a. m..	15.25	31.7	1.75	0.838	0.911	48	54	0.180	27.60	n.	15	47.8	6	5	Light smoke..	Few cirrus; few cumulo-stratus on horizon.
12:38 p. m..	0.50	33.6	1.66	0.765	0.832	50	52	0.187	27.58	nw.	12	43.0	6	5	Partly cloudy.	1 cirrus; few alto-stratus; few cumulo-stratus.
3:03 p. m..	35.75	24.0	2.24	0.790	0.859	54	52	0.211	27.51	nw.	13	15.2	1	4	Light smoke..	7 alto-cumulus.
4:02 p. m..	50.50	15.9	3.31	*0.184	0.200	51	57	0.211	27.51	nw.	18	18.2	3	2	Partly cloudy.	7 cirrus; 1 alto-cumulus.
January 19.																
9:09 a. m..	53.00	14.7	3.63	0.575	0.625	25	58	0.089	27.98	se.	18	48.7	8	9	Light smoke..	No clouds.
9:35 a. m..	46.50	18.7	2.89	0.522	0.567	26	49	0.066	27.99	se.	18	48.4	8	10	....do	Do.
10:34 a. m..	31.75	26.3	2.08	0.703	0.764	30	41	0.066	28.00	se.	7	50.5	8	10	....do	Do.
11:36 a. m..	16.25	31.9	1.76	0.790	0.859	31	37	0.063	28.01	se.	9	50.5	9	9	....do	Do.
12:34 p. m..	1.75	33.9	1.68	0.776	0.843	34	35	0.063	28.00	se.	13	49.9	9	6	... do	Do.
1:33 p. m..	13.00	32.6	1.73	0.770	0.837	35	35	0.074	27.97	se.	12	48.8	8	5	....do	Do.
3:04 p. m..	35.75	24.5	2.24	0.679	0.738	37	42	0.089	27.92	se.	10	48.6	8	4	....do	Do.
4:04 p. m..	50.75	16.1	3.32	0.477	0.518	37	35	0.081	27.92	se.	8	46.8	8	4	....do	Do.
4:35 p. m..	58.50	11.2	4.66	0.336	0.365	36	35	0.074	27.92	se.	7	43.6	7	4	... do	Do.
January 22.																
9:43 a. m..	44.75	20.5	2.63	0.546	0.593	35	74	0.150	27.76	n.	15	31.8	7	6	Partly cloudy.	3 cirrus; 1 cumulo-stratus.
10:31 a. m..	32.75	26.5	2.07	0.212	0.230	36	75	0.157	27.76	nw.	18	12.2	1	5	....do	9 alto-stratus; 1 cumulo-stratus.
11:33 a. m..	17.25	32.2	1.74	0.624	0.678	38	67	0.150	27.76	n.	12	13.0	1	3	....do	9 alto-stratus.
12:39 p. m..	0.75	34.6	1.63	0.212	0.230	40	65	0.164	27.75	nw.	12	13.8	2	3	Cloudy	9 cirrus.
1:31 p. m..	12.25	33.4	1.68	0.810	0.880	42	62	0.164	27.72	n.	10	25.6	5	3	Partly cloudy.	6 cirrus.
3:04 p. m..	35.50	25.1	2.17	0.606	0.659	41	57	0.143	27.70	nw.	11	41.8	6	2	Light smoke..	1 cirrus near sun.
4:06 p. m..	51.00	16.4	3.24	0.324	0.352	41	51	0.136	27.71	nw.	15	40.6	6	2	Dense smoke..	Few cirrus.
5:00 p. m..	64.50	7.6	6.58	0.234	0.254	40	52	0.124	27.73	nw.	12	32.2	5	2	Light smoke..	No clouds.
January 23.																
9:13 a. m..	52.25	15.9	3.36	0.286	0.311	33	79	0.150	27.89	n.	2	44.9	6	1	Light smoke..	Few cirrus; few alto-stratus.
9:39 a. m..	45.75	19.9	2.71	0.351	0.382	33	72	0.136	27.90	n.	2	45.2	6	2	....do	Few alto-stratus.
10:35 a. m..	31.75	27.1	2.03	0.542	0.589	40	66	0.164	27.90	sw.	2	44.8	6	2	....do	Few alto-cumulus in north.
11:35 a. m..	16.75	32.5	1.72	0.613	0.666	44	60	0.180	27.89	nw.	2	46.2	7	2	....do	Do.
12:34 p. m..	2.00	34.7	1.63	0.736	0.800	47	53	0.172	27.87	nw.	5	38.8	6	3	....do	5 alto-cumulus.
1:34 p. m..	13.00	33.7	1.67	0.680	0.739	50	54	0.195	27.84	nw.	4	46.8	7	2	Partly cloudy.	Few alto-cumulus; few alto-stratus; coronal bands.
3:04 p. m..	35.50	25.3	2.16	0.598	0.650	50	53	0.195	27.80	w.	3	45.2	7	2	Light smoke..	Few alto-cumulus.
4:04 p. m..	50.50	17.0	3.14	0.358	0.389	50	45	0.164	27.79	ne.	3	40.0	6	1	....do	Few cirrus; few alto-cumulus.
January 26.																
11:34 a. m..	17.25	33.1	1.70	0.301	0.327	44	84	0.247	27.98	s.	7	10.3	1	6	Cloudy	10 cirro-stratus.
12:32 p. m..	2.75	35.4	1.60	0.709	0.771	49	71	0.247	27.96	s.	6	13.2	2	6	....do	5 cirrus; 5 cirro-stratus.
1:34 p. m..	12.75	34.2	1.65	0.638	0.693	55	56	0.247	27.93	s.	6	12.2	2	5	....do	10 cirro-stratus.
3:12 p. m..	37.25	24.9	2.20	0.476	0.517	55	46	0.195	27.91	se.	15	37.0	9	4	Partly cloudy.	9 alto-stratus.
4:04 p. m..	50.25	17.6	3.05	*0.604	0.657	53	44	0.180	27.91	se.	12	41.0	5	4	....do	8 cirrus; 1 alto-stratus.
5:10 p. m..	66.75	6.6	7.46	0.172	0.187	46	70	0.219	27.96	s.	12	11.0	1	5	Light smoke..	1 cirrus; 10 cumulus; 7 alto-stratus.
January 28.																
10:48 a. m..	28.75	29.5	1.89	0.410	0.446	49	93	0.322	27.82	n.	5	22.2	4	2	Partly cloudy.	4 cirrus; 5 cirro-stratus; 1 stratus.
11:35 a. m..	17.00	33.7	1.67	0.478	0.520	56	80	0.360	27.81	n.	2	9.4	1	2	....do	10 cirro-stratus; solar halo, 22° radius.

TABLE 8.—*Pyrheliometer observations at Asheville, N. C.*—Continued.

Date and time (75th meridian time).	Hour angle.	*h.*	*e.*	*Q'.*	*Q.*	*t.*	*R. H.*	*e.*	*B.*	Wind.		*P.*	Sky.	Mt.	Character of sky.	
										Dir.	Vel.				At sun.	In general.
January 29.	°	°				°F.	%	*Inch.*	*Inches.*		*M. p. h.*	%				
9:14 a. m..	52.25	17.0	3.12	0.264	0.287	52	91	0.360	27.61	s.	4	17.2	2	0	Cloudy	9 cirrus; 1 stratus.
9:37 a. m..	46.50	20.5	2.61	0.272	0.296	54	86	0.360	27.61	se.	6	18.6	2	0	....do	Do.
11:25 a. m..	19.50	33.2	1.68	0.124	0.135	59	79	0.387	27.56	se.	8	8.6	0	5	....do	10 alto-stratus.
12:35 p. m..	2.00	36.2	1.56	0.110	0.120	60	78	0.402	27.56	se.	12	7.9	0	6	....do	Do.
1:39 p. m..	14.00	34.7	1.61	0.562	0.611	63	70	0.402	27.52	se.	12	13.2	1	5	....do	9 cirrus; few alto-stratus.
3:06 p. m..	35.75	26.5	2.05	0.211	0.229	62	74	0.417	27.50	se.	13	17.8	3	3	....do	9 cirrus; few cumulo-stratus.
4:10 p. m..	51.75	17.3	3.06	0.222	0.241	62	74	0.417	27.50	se.	13	15.2	1	3	....do	10 cirro-stratus; few cumulo-stratus.
5:03 p. m..	65.00	8.2	6.07	0.072	0.078	60	75	0.402	27.50	se.	12	16.8	1	3	....do	Do.
January 30.																
9:16 a. m..	51.75	17.5	3.05	0.352	0.383	35	74	0.150	27.72	nw.	24	39.4	7	10	Partly cloudy	1 alto-stratus; few cumulus.
10:37 a. m..	31.50	28.8	1.92	0.662	0.720	36	62	0.130	27.75	nw.	30	41.0	7	8	Dense smoke..	Few cirrus; few cumulo-stratus.
11:44 a. m..	14.75	34.8	1.62	0.757	0.823	38	60	0.136	27.76	nw.	25	42.2	8	8	Light smoke..	Few fracto-cumulus.
12:34 p. m..	2.25	36.5	1.56	0.724	0.787	40	58	0.143	27.77	nw.	24	43.5	8	9	....do	Do.
1:58 p. m..	18.75	33.7	1.67	0.771	0.838	40	46	0.113	27.77	nw.	22	43.2	8	5	....do	No clouds.
3:08 p. m..	36.25	26.5	2.07	0.718	0.780	42	38	0.098	27.77	nw.	18	41.2	8	4	....do	Do.
4:03 p. m..	50.00	18.6	2.89	0.578	0.628	42	39	0.098	27.80	nw.	18	39.2	8	3	....do	Do.
5:04 p. m..	65.25	8.3	6.08	0.250	0.272	38	36	0.085	27.81	nw.	17	31.6	7	3	....do	Few cirrus.
5:32 p. m..	72.25	3.3	13.00	0.141	0.153	37	39	0.081	27.82	nw.	12	31.5	6	.....	....do	Do.
January 31.																
9:26 a. m..	49.50	19.1	2.84	0.524	0.570	33	64	0.103	27.99	nw.	7	43.3	8	10	Partly cloudy.	7 cirrus.
10:35 a. m..	32.25	28.7	1.94	0.685	0.745	36	52	0.108	28.00	nw.	5	44.0	8	10	Light smoke..	1 cirrus near sun.
11:46 a. m..	14.50	35.1	1.62	0.784	0.852	43	41	0.113	27.99	nw.	5	38.0	4	8	Dense smoke..	1 cirrus; 2 cirro-stratus near sun.
12:37 p. m..	1.75	36.7	1.56	0.684	0.743	47	35	0.118	27.96	nw.	6	20.2	3	6	Cloudy	10 cirro-stratus.
1:35 p. m..	12.75	35.5	1.60	0.344	0.374	48	35	0.113	27.93	nw.	4	17.8	2	4	....do	10 cirro-stratus; solar halo, 22° radius.
3:07 p. m..	35.75	27.0	2.04	0.215	0.234	51	32	0.113	27.91	nw.	4	12.4	1	4	....do	Do.
4:03 p. m..	49.75	18.9	2.85	0.033	0.036	50	32	0.118	27.91	nw.	3	7.4	0	4	....do	10 cirro-stratus; no shadow.
5:05 p. m..	65.25	8.4	6.04	0.001	0.001	48	29	0.098	27.90	nw.	3	7.8	0	3	....do	10 alto-stratus; no shadow.
5:28 p. m..	71.00	4.3	10.70	0.001	0.001	.....	.....	.....	27.90	w.	2	.....	0	3	....do	Do.
February 4.																
9:35 a. m..	47.75	21.2	2.40	0.361	0.392	59	52	0.266	27.32	w.	10	18.2	8	10	Partly cloudy.	9 alto-stratus.
10:37 a. m..	31.75	29.9	1.83	0.058	0.063	58	23	0.113	27.32	w.	18	28.7	9	10	Cloudy	Few cirrus; 5 alto-stratus.
11:53 a. m..	12.75	36.6	1.52	0.036	0.039	57	32	0.150	27.31	nw.	8	45.8	8	10	....do	1 alto-stratus; no shadow.
12:37 p. m..	1.75	37.9	1.49	1.026	1.115	59	22	0.108	27.31	sw.	23	47.4	8	9	Clear	Few alto-stratus in southeast.
1:36 p. m..	13.00	36.6	1.52	0.971	1.055	57	25	0.113	27.27	sw.	23	46.6	8	7	....do	Few alto-stratus.
3:01 p. m..	34.25	28.7	1.89	0.888	0.965	57	21	0.098	27.27	sw.	20	47.0	9	4	Light smoke..	Do.
4:06 p. m..	50.50	19.4	2.73	0.698	0.759	56	22	0.098	27.29	sw.	15	45.2	8	4	....do	Few alto-stratus in south.
5:01 p. m..	64.25	9.9	5.12	0.460	0.500	53	17	0.070	27.30	sw.	18	40.2	7	4	....do	Do.
5:44 p. m..	75.00	2.1	16.90	0.106	0.115	49	24	0.081	27.32	w.	20	37.5	6	.....	....do	Do.
February 5.																
10:28 a. m..	34.00	29.0	1.91	0.464	0.504	27	64	0.093	27.87	nw.	30	31.4	5	5	Partly cloudy.	5 cirro-stratus; light snow.
12:40 p. m..	1.00	38.2	1.51	0.906	0.985	32	66	0.124	27.88	nw.	23	47.5	7	4	Light smoke..	Few fracto-cumulus.
1:36 p. m..	13.00	36.5	1.55	0.858	0.933	33	63	0.118	27.86	nw.	19	47.9	7	4	Dense smoke..	Few alto-stratus; few cumulo-stratus.
3:05 p. m..	35.25	28.4	1.96	0.809	0.879	35	56	0.113	27.87	nw.	25	48.0	8	3	....do	Few cirrus.
4:11 p. m..	51.75	18.8	2.86	0.688	0.748	34	60	0.113	27.88	nw.	24	46.2	7	.....	Light smoke..	No clouds.
February 6.																
9:15 a. m..	52.25	18.7	2.90	0.019	0.021	29	72	0.113	28.02	nw.	1	15.0	2	1	Cloudy	10 alto-cumulus; no shadow.
11:06 a. m..	24.50	33.7	1.69	0.003	0.003	35	54	0.113	28.02	e.	2	4.2	1	1	....do	10 alto-stratus; no shadow.
12:49 p. m..	1.25	38.5	1.49	0.054	0.059	43	43	0.118	27.96	e.	3	4.5	0	2	....do	Do.
1:32 p. m..	12.00	37.4	1.53	0.002	0.002	44	42	0.124	27.93	s.	4	5.2	0	2	....do	Do.
February 9.																
9:41 a. m..	45.75	23.5	2.32	0.608	0.661	34	76	0.150	27.91	nw.	23	38.5	7	4	Light smoke..	Few cumulo-stratus in west.
10:35 a. m..	32.25	31.0	1.80	0.654	0.711	36	72	0.157	27.93	nw.	15	40.3	8	4	....do	No clouds.
11:35 a. m..	17.25	37.0	1.55	0.734	0.798	40	67	0.164	27.95	nw.	15	40.4	8	3	....do	Do.
12:34 p. m..	2.50	39.4	1.48	0.708	0.770	43	60	0.172	27.94	nw.	20	41.6	8	3	....do	Do.
1:35 p. m..	12.75	38.1	1.51	0.750	0.815	45	58	0.180	27.91	nw.	15	41.4	8	3	....do	Do.
3:05 p. m..	35.25	29.5	1.88	0.650	0.707	47	48	0.157	27.89	nw.	12	41.2	8	3	Partly cloudy.	1 cirrus.
4:05 p. m..	50.25	20.7	2.62	0.398	0.433	48	40	0.130	27.90	nw.	12	36.0	6	3	....do	5 cirro-stratus.
5:03 p. m..	64.75	10.6	4.91	0.214	0.233	45	50	0.150	27.91	n.	5	24.8	5	3	....do	9 cirro-stratus.
5:48 p. m..	76.00	2.4	16.10	0.029	0.032	43	54	0.150	27.91	nw.	7	28.2	4	.....	Cloudy	Do.
February 10.																
10:38 a. m..	31.50	31.6	1.78	0.014	0.015	44	60	0.172	27.98	se.	12	3.4	0	3	....do	10 alto-stratus; no shadow.
February 11.																
3:14 p. m..	37.50	28.8	1.89	0.786	0.854	58	48	0.228	27.36	sw.	15	34.0	9	3	Light smoke..	4 cumulus near sun.
4:05 p. m..	50.25	21.2	2.51	0.573	0.623	56	48	0.211	27.38	sw.	16	28.2	9	3	....do	Do.
5:00 p. m..	64.00	11.6	4.43	0.123	0.134	54	50	0.211	27.41	nw.	18	.....	0	3	Partly cloudy.	9 cumulo-stratus.
February 12.																
9:12 a. m..	53.00	19.6	2.75	0.357	0.388	38	30	0.211	27.81	nw.	2	45.0	9	4	Light smoke..	No clouds.
10:34 a. m..	32.50	31.4	1.77	0.594	0.646	44	79	0.228	27.81	nw.	2	46.1	9	6	....do	Do.
11:34 a. m..	17.50	37.8	1.51	0.698	0.759	49	69	0.237	27.80	sw.	3	46.3	8	6	....do	Do.
12:35 p. m..	2.25	40.4	1.43	0.856	0.930	57	56	0.256	27.79	sw.	2	47.6	8	6	....do	Do.
1:35 p. m..	12.75	39.0	1.47	0.927	1.008	61	39	0.203	27.75	se.	7	49.1	8	6	....do	Do.
3:05 p. m..	35.25	30.3	1.82	0.900	0.978	63	24	0.136	27.70	se.	15	49.5	8	4	....do	Do.
4:03 p. m..	49.75	21.7	2.49	0.806	0.876	60	28	0.143	27.71	s.	18	48.2	8	4	....do	Do.
5:04 p. m..	65.00	11.0	4.71	0.575	0.625	59	24	0.113	27.72	se.	14	43.4	7	3	....do	Do.
5:49 p. m..	76.25	2.8	14.60	0.162	0.176	56	36	0.172	27.72	se.	12	.....	.....	.....	..do	Do.
February 13.																
9:16 a. m..	52.00	2.5	2.64	0.495	0.538	38	78	0.180	27.89	n.	4	49.2	8	3	Partly cloudy.	1 cirrus.
10:33 a. m..	32.75	31.9	1.75	0.676	0.735	48	65	0.219	27.89	calm.	.....	47.4	6	3	Light smoke..	Do.
11:34 a. m..	17.50	38.1	1.51	0.958	1.041	58	53	0.256	27.88	nw.	9	51.4	9	5	....do	Do.
12:34 p. m..	2.50	40.7	1.42	1.036	1.126	61	50	0.277	27.87	nw.	10	51.8	8	5	....do	No clouds.
1:34 p. m..	12.50	39.4	1.46	1.000	1.087	62	40	0.219	27.86	nw..	6	51.8	9	4	....do	Do.
3:04 p. m..	35.00	30.7	1.81	0.867	0.942	64	34	0.211	27.82	nw.	3	51.0	8	3	....do	Do.
4:04 p. m..	50.00	21.8	2.48	0.570	0.620	66	37	0.266	27.82	w.	1	49.1	7	3	....do	Do.
5:04 p. m..	65.00	11.3	4.61	0.314	0.341	64	42	0.247	27.83	w.	2	46.0	6	3	....do	Do.
5:58 p. m..	78.50	1.3	22.00	0.062	0.067	60	46	0.237	27.84	sw.	1	47.9	6	.....	....do	Do.
February 14.																
9:10 a. m..	53.50	19.7	2.74	*0.010	0.011	45	87	0.256	27.91	w.	1	.....	0	.....	Cloudy	10 alto-stratus.
10:42 a. m..	30.50	33.3	1.69	0.008	0.009	54	74	0.310	27.90	n.	1	10.1	1	0	....do	10 alto-stratus; no shadow.
11:43 a. m..	15.25	39.0	1.48	0.189	0.205	60	59	0.310	27.87	se.	5	5.0	1	2	....do	10 alto-stratus.

* Mean of two readings only; radiation too small to measure after second reading. † Galvanometer defective. ‡ Galvanometer not sufficiently sensitive for accurate work; remedied before next day.

TABLE 9.—*Pyrheliometer observations at Black Mountain, N. C. Latitude, 35° 36′ north; longitude, 82° 19′ west. Elevation above sea level, 2400 feet.*

Date and time (75th meridian time).	Hour angle.	A.	e.	Q′.	Q.	t.	R. H.	e.	B.	Wind.		P.	Sky.	Mt.	Character of sky.	
										Dir.	Vel.				At sun.	In general.
February 19.	°	°				°F.	%	Inch.	Inches.		M. p. h.	%				
9:40 a. m..	45.75	26.8	2.07	0.640	0.696	20	58	0.060	27.99	nw.	8	46.8	9	10	Clear	1 cirrus near sun.
10:33 a. m..	32.50	33.7	1.68	0.662	0.720	22	52	0.057	27.99	nw.	6	48.0	9	9	....do	Few cirrus.
11:36 a. m..	16.75	40.2	1.45	0.790	0.859	27	54	0.077	27.98	n.	6	47.7	9	10	....do	Do.
12:35 p. m..	2.00	42.8	1.37	0.844	0.917	31	53	0.093	27.96	n.	3	47.2	8	10	....do	Few cirrus in north.
2:05 p. m..	20.50	38.2	1.51	0.786	0.854	36	45	0.098	27.90	se.	2	46.7	9	10	....do	2 cirrus near sun.
3:07 p. m..	36.00	31.8	1.76	0.646	0.702	38	42	0.093	27.87	se.	3	40.5	5	10	Cloudy	9 cirrus; very fine.
4:05 p. m..	50.50	23.0	2.36	0.529	0.575	35	52	0.108	27.87	s.	4	43.0	6	10	Partly cloudy.	6 cirrus; very fine.
5:05 p. m..	65.50	12.6	4.16	0.399	0.434	32	51	0.093	27.86	s.	8	44.8	8	10	Clear	No clouds.
5:39 p. m..	74.00	6.3	7.76	0.214	0.233	31	41	0.070	27.86	se.	12	38.0	7	8	....do	Do.
February 20.																
9:10 a. m..	53.25	21.4	2.54	0.648	0.704	34	58	0.113	27.91	n.	20	46.8	9	10	....do	1 fracto-cumulus.
10:35 a. m..	32.00	34.2	1.65	0.819	0.890	36	53	0.113	27.92	n.	15	49.7	9	10	....do	Few cirro-stratus in south.
11:34 a. m..	17.25	40.4	1.44	0.922	1.002	41	44	0.118	27.91	n.	12	49.0	9	10	....do	Do.
12:35 p. m..	2.00	43.1	1.36	0.906	0.985	41	42	0.108	27.90	n.	12	39.3	7	10	....do	9 cirrus near sun.
2:04 p. m..	20.25	39.3	1.47	0.578	0.628	42	41	0.113	27.87	nw.	4	19.6	3	10	Cloudy	1 cirrus; 9 cirro-stratus; solar halo, 22° radius.
3:06 p. m..	35.75	32.2	1.74	0.532	0.578	44	34	0.098	27.83	n.	7	29.7	4	9	....do	10 cirro-stratus; solar halo, 22° radius.
4:05 p. m..	50.50	23.5	2.32	0.269	0.292	43	31	0.085	27.83	nw.	4	19.0	4	9	....do	Do.
5:04 p. m..	65.25	12.9	4.06	0.112	0.122	41	42	0.108	27.83	n.	4	16.0	2	9	....do	Do.
5:43 p. m..	75.00	5.6	8.63	0.005	0.005	34	65	0.124	27.83	nw.	4	16.8	3	7	....do	10 cirro-stratus; no shadow.
February 21.																
9:49 a. m..	43.50	28.1	1.96	0.024	0.026	38	70	0.157	27.77	n.	6	7.0	1	7	....do	10 alto-stratus; shadow with readings 1 and 4.
10:36 a. m..	31.75	34.6	1.63	0.012	0.013	41	57	0.143	27.75	nw.	6	5.5	1	8	....do	10 alto-stratus; no shadow.
12:37 p. m..	1.50	43.5	1.34	0.750	0.815	52	38	0.150	27.70	nw.	15	25.0	3	10	....do	9 cirrus.
2:07 p. m..	21.00	39.3	1.46	0.906	0.985	50	35	0.130	27.65	n.	20	46.8	7	10	Clear	1 cirrus near sun.
3:08 p. m..	36.25	32.4	1.72	0.786	0.854	48	27	0.089	27.64	n.	30	50.6	9	10	....do	Few cirrus.
4:05 p. m..	50.50	23.8	2.27	0.713	0.775	46	36	0.108	27.63	n.	30	49.0	9	10	....do	Do.
5:05 p. m..	65.50	12.7	4.10	0.402	0.437	43	44	0.118	27.64	n.	25	45.2	8	9	....do	No clouds.
5:44 p. m..	75.25	5.6	8.57	0.128	0.139	40	50	0.124	27.63	n.	20	37.4	6	8	....do	No clouds; tree shades sun.
February 23.																
7:41 a. m..	75.50	6.0	8.11	0.234	0.254	18	98	0.089	28.01	sw.	2	37.4	8	10	....do	No clouds.
8:37 a. m..	61.50	16.4	3.28	0.526	0.572	30	79	0.130	28.01	sw.	3	46.3	9	10	....do	Do.
9:36 a. m..	46.75	26.6	2.08	0.694	0.754	36	65	0.143	28.01	sw.	3	47.8	9	10	....do	Do.
10:35 a. m..	32.00	25.3	1.62	0.800	0.870	42	45	0.118	27.99	sw.	4	47.9	9	10	....do	Do.
11:36 a. m..	16.75	41.6	1.41	0.838	0.911	48	29	0.098	27.98	sw.	3	48.5	9	10	....do	Do.
12:35 p. m..	2.00	44.2	1.34	0.904	0.983	53	26	0.108	27.96	sw.	3	48.0	9	10	....do	Do.
2:05 p. m..	20.50	40.3	1.44	0.780	0.848	55	33	0.143	27.91	sw.	3	36.4	8	10	Partly cloudy.	Fine cirrus over most of sky.
5:35 p. m..	73.00	7.4	6.69	0.004	0.004	46	41	0.130	27.85	s.	6	11.4	2	7	Cloudy	10 cirro-stratus; no shadow.
February 24.																
7:44 a. m..	74.75	7.2	6.84	0.160	0.174	22	96	0.103	27.78	nw.	4	33.3	6	9	Clear	No clouds.
8:38 a. m..	61.25	17.0	3.14	0.359	0.390	30	83	0.136	27.78	n.	4	42.2	7	7	Light haze....	Do.
9:36 a. m..	46.75	27.1	2.02	0.564	0.613	39	68	0.164	27.77	nw.	5	43.2	8	7	....do	Do.
10:36 a. m..	31.75	35.9	1.58	0.766	0.833	48	40	0.136	27.76	nw.	10	43.3	8	7	....do	Do.
12:35 p. m..	2.00	44.6	1.32	0.902	0.980	55	21	0.093	27.73	nw.	20	40.4	8	8	....do	1 cirrus.
2:07 p. m..	21.00	40.6	1.43	0.732	0.796	56	24	0.103	27.69	nw.	15	33.8	6	8	Partly cloudy.	Fine cirrus over most of sky.
3:06 p. m..	35.75	33.8	1.66	0.488	0.530	56	23	0.103	27.67	nw.	15	21.6	4	8	Cloudy	9 cirrus.
4:07 p. m..	51.00	24.0	2.26	0.393	0.427	54	28	0.113	27.67	n.	20	30.8	6	8	....do	Do.
5:35 p. m..	73.00	8.1	6.17	0.011	0.012	48	40	0.130	27.68	n.	20	15.3	2	7	....do	5 cirrus; 5 cirro-stratus; no shadow.
February 25.																
7:48 a. m..	73.75	8.8	5.78	0.172	0.187	23	99	0.118	27.84	w.	3	35.2	6	7	....do	Fine cirrus over most of sky.
9:41 a. m..	45.50	28.1	1.96	0.418	0.454	41	65	0.172	27.87	sw.	2	26.6	3	7	....do	10 cirro-stratus.
10:37 a. m..	31.50	36.2	1.57	0.646	0.702	43	64	0.172	27.87	s.	3	36.4	4	7	....do	5 cirrus; 4 cirro-stratus.
12:35 p. m..	2.00	45.0	1.31	0.485	0.527	47	58	0.187	27.86	s.	10	19.3	3	6	....do	5 cirrus; 5 cirro-stratus; solar halo, 22° radius.
2:06 p. m..	20.75	41.2	1.41	0.420	0.457	49	49	0.172	27.85	se.	10	23.0	3	6	....do	1 cirrus; 8 cirro-stratus; solar halo, 22° radius.
3:05 p. m..	35.50	34.6	1.64	0.259	0.282	49	49	0.172	27.84	se.	12	17.5	3	3	....do	3 cirrus; 7 cirro-stratus; solar halo, 22° radius.
4:07 p. m..	51.00	24.8	2.27	0.035	0.038	48	52	0.180	27.84	se.	12	6.8	1	3	....do	10 cirro-stratus; no shadow.
5:05 p. m..	65.50	14.6	3.63	0.005	0.005	46	49	0.157	27.85	se.	10	7.3	1	3	....do	Do.
5:44 p. m..	75.25	7.2	6.86	0.006	0.007	45	51	0.150	27.86	se.	12	20.0	2	3	....do	Do.
February 26.																
7:46 a. m..	74.00	7.7	6.56	0.142	0.154	28	89	0.130	27.97	s.	4	32.3	7	6	Light haze....	Few cirrus.
8:49 a. m..	58.85	19.8	2.74	0.378	0.411	39	57	0.130	28.00	s.	4	36.8	7	7	Partly cloudy.	Fine cirrus over most of sky.
9:34 a. m.	47.00	27.2	2.04	0.584	0.635	42	53	0.143	28.00	s.	6	38.6	7	7	Light haze....	1 cirrus in south.
10:37 a. m..	31.75	36.6	1.56	0.390	0.424	47	45	0.143	28.00	s.	6	32.0	7	6	Partly cloudy.	1 cirrus; 8 alto-stratus; sun obscured last reading.
12:36 p. m..	1.50	45.4	1.31	0.316	0.343	52	46	0.172	27.99	s.	12	2.9	0	3	....do	10 alto-stratus; sun obscured last two readings.
February 28.																
8:56 a. m..	56.50	21.5	2.47	0.438	0.476	60	72	0.373	27.22	sw.	18	30.2	8	9	Partly cloudy.	2 cirrus; 1 alto-cumulus; 2 cumulo-stratus.
9:35 a. m..	46.75	28.4	1.90	0.704	0.765	63	48	0.277	27.22	sw.	18	10.8	2	9	....do	4 alto-stratus; 4 alto-cumulus; 1 cumulo-stratus.
10:37 a. m..	31.25	37.1	1.51	0.012	0.013	60	44	0.219	27.26	sw.	20	6.5	1	9	Cloudy	10 cumulo-stratus; no shadow after 1st reading.
12:39 p. m..	0.75	46.2	1.27	0.292	0.317	60	40	0.211	27.29	sw.	24	16.9	2	10	....do	1 cirrus; 8 cirro-stratus; solar halo, 22° radius.
2:06 p. m..	21.00	42.2	1.36	0.194	0.211	60	43	0.219	27.29	nw.	5	6.4	1	9	....do	10 alto-stratus; no shadow last reading.
3:11 p. m..	37.25	34.4	1.61	0.390	0.424	60	37	0.187	27.30	sw.	15	18.4	4	9	Partly cloudy.	9 cirrus.
4:04 p. m..	50.50	25.9	2.08	0.618	0.672	58	45	0.219	27.32	nw.	10	23.6	7	8	....do	5 cirrus; 3 cirro-stratus; 1 cirro-cumulus.
March 2.																
8:56 a. m..	56.50	21.8	2.49	0.242	0.263	32	67	0.118	27.89	se.	3	35.2	7	9	....do	1 cirrus; 8 cirro-stratus.
9:33 a. m..	47.25	18.2	1.96	0.003	0.003	33	70	0.124	27.89	s.	3	15.6	1	8	Cloudy	5 cirro-stratus; 5 alto-stratus.
10:37 a. m..	31.25	38.0	1.51	0.476	0.517	41	55	0.136	27.89	s.	2	25.6	4	8	Partly cloudy.	9 cirro-stratus; 1 alto-cumulus.
11:37 a. m..	16.25	44.3	1.33	0.127	0.138	41	64	0.164	27.89	s.	4	4.4	0	6	Cloudy	1 alto-cumulus; 9 alto-stratus.
12:33 p. m..	2.25	46.9	1.28	0.128	0.139	42	64	0.172	27.88	sw.	4	2.4	0	6	Partly cloudy.	4 alto-cumulus; 4 alto-stratus; shadow with 4th reading.
March 3.																
7:30 a. m..	78.00	6.0	8.09	0.188	0.204	26	90	0.124	27.94	calm.	.....	42.2	8	8	Clear	Few cirrus in northwest.
8:35 a. m..	61.75	18.4	2.93	0.464	0.504	36	80	0.164	27.95	sw.	3	45.8	8	8	....do	1 alto-cumulus in north.
9:34 a. m..	47.00	28.9	1.92	0.724	0.787	44	66	0.187	27.95	sw.	3	46.8	8	7	Light haze....	Do.
10:36 a. m..	31.50	38.3	1.50	0.814	0.885	50	52	0.187	27.94	sw.	4	47.4	8	8	....do	Few alto-cumulus in northeast.
12:34 p. m..	2.00	47.3	1.27	0.814	0.885	52	48	0.187	27.92	s.	7	47.2	8	7	....do	No clouds.
2:07 p. m..	21.25	42.8	1.37	0.772	0.839	53	45	0.180	27.89	s.	7	46.1	8	6	....do	Do.
3:04 p. m..	35.50	35.9	1.58	0.723	0.786	53	43	0.172	27.89	s.	10	45.4	8	6	....do	Few cirrus in west.
4:05 p. m..	50.75	26.3	2.09	0.566	0.615	53	45	0.180	27.88	s.	10	43.6	8	7	....do	1 cirrus.
5:17 p. m..	68.78	13.0	4.04	0.204	0.222	52	58	0.228	27.89	se.	7	20.1	3	5	....do	Few cirrus; 1 alto-stratus.
March 5.																
8:45 a. m..	59.00	20.7	2.60	0.644	0.700	54	80	0.334	27.73	sw.	4	31.0	6	8	....do	1 cirrus; 2 cirro-stratus; few cumulo-stratus.
9:33 a. m..	47.00	29.3	1.88	0.292	0.317	56	77	0.334	27.73	nw.	2	3.2	1	6	Cloudy	4 cirro-stratus; 6 cumulo-stratus; solar halo, 22° radius.
10:33 a. m..	32.00	38.4	1.49	0.050	0.054	60	70	0.360	27.73	nw.	6	2.8	0	8	....do	6 alto-stratus; 4 alto-cumulus; no shadow.
12:28 p. m..	3.25	47.9	1.25	0.004	0.004	63	66	0.373	27.72	nw.	4	2.0	0	8	....do	9 alto-stratus; 1 cumulo-stratus; sun not visible.
March 6.																
9:21 a. m..	50.00	27.8	1.98	0.348	0.378	56	89	0.402	27.76	nw.	2	11.6	1	6	Partly cloudy.	9 cumulo-stratus.
10:34 a. m..	31.75	39.1	1.47	0.275	0.299	61	78	0.417	27.77	sw.	4	4.8	1	7	Cloudy	3 alto-stratus; 7 cumulo-stratus.
12:33 p. m..	2.00	48.4	1.24	0.176	0.191	62	77	0.432	27.74	sw.	4	3.4	0	7	....do	9 cirro-stratus; 1 cumulo-stratus; solar halo, 22° radius.
2:04 p. m..	20.75	44.0	1.33	0.077	0.084	62	77	0.432	27.71	e.	9	2.6	0	7	....do	Do.
3:00 p. m..	34.75	38.0	1.50	0.000	0.000	62	77	0.432	27.70	e.	7	.....	0	7	....do	10 cumulo-stratus; sun not visible.
March 9.																
9:00 a. m..	55.00	24.9	2.19	0.018	0.020	59	88	0.448	27.79	sw.	4	34.4	7	5	....do	1 cirrus; 6 alto-cumulus; no shadow.
10:51 a. m..	27.25	42.2	1.38	0.064	0.070	66	65	0.417	27.78	s.	7	3.8	1	6	....do	8 alto-stratus; 2 cumulus; shadow 1st reading.
11:33 a. m..	16.75	46.7	1.27	0.964	1.048	72	68	0.499	27.78	se.	6	4.8	0	7	Clear	1 cirrus; 4 alto-stratus; 3 cumulus.

TABLE 9.—*Pyrheliometer observations at Black Mountain, N. C.*—Continued.

Date and time (75th meridian time).	Hour angle.	*h.*	*e.*	*Q'.*	*Q.*	*t.*	*R. H.*	*e.*	*B.*	Wind.		*P.*	Sky.	Mt.	Character of sky.	
										Dir.	Vel.				At sun.	In general.
Mar. 9—*Conf'd.*	°	°				°F.	%	*Inch.*	*Inches.*		*M. p. h.*	%				
12:38 p. m..	0. 50	49. 6	1. 22	0. 001	0. 001	68	68	0. 448	27. 77	s.	10	.....	0	7	Cloudy	1 alto-stratus; 9 cumulo-stratus; sun not visible after 1st reading.
2:06 p. m..	21. 50	44. 9	1. 32	0. 506	0. 550	67	76	0. 499	27. 74	s.	6	3. 5	0	7	....do	1 cirrus; 2 alto-stratus; 7 cumulus.
3:11 p. m..	37. 75	36. 5	1. 56	0. 023	0. 025	67	75	0. 482	27. 72	s.	6	3. 0	0	7	....do	9 alto-stratus; 1 cumulus.
March 12.																
11:05 a. m..	23. 50	44. 8	1. 32	0. 142	0. 154	57	91	0. 432	27. 77	se.	10	0. 8	0	0	....do	10 stratus; light rain; shadow with 2d and 3d reading.
2:06 p. m..	21. 75	45. 9	1. 29	0. 330	0. 359	57	88	0. 417	27. 71	se.	10	1. 2	0	0	....do	10 stratus; no shadow last reading.
3:11 p. m..	38. 00	26. 9	1. 54	0. 001	0. 001	56	89	0. 417	27. 71	se.	9	1. 0	0	0	....do	10 stratus; sun not visible after 1st reading.
March 13.																
10:49 a. m..	27. 50	43. 6	1. 34	0. 004	0. 004	54	86	0. 360	27. 73	e.	3	2. 6	0	0	....do	10 stratus; no shadow.
11:35 a. m..	16. 00	48. 6	1. 23	0. 016	0. 017	54	84	0. 347	27. 71	e.	4	0. 2	0	0	....do	Do.
12:31 p. m..	2. 00	51. 1	1. 19	0. 002	0. 002	54	87	0. 360	27. 70	se.	7	1. 2	0	0	....do	10 stratus; sun not visible after 1st reading.
March 17.																
11:52 a. m..	11. 50	51. 4	1. 19	0. 023	0. 025	61	73	0. 402	27. 76	s.	2	5. 8	1	3	....do	9 alto-cumulus; 1 cumulo-stratus; no shadow.
1:59 p. m..	20. 25	48. 4	1. 24	0. 005	0. 005	62	67	0. 373	27. 71	se.	9	0. 8	0	3	....do	5 alto-cumulus; 5 cumulo-stratus; no shadow.
5:48 p. m..	77. 50	9. 3	5. 49	0. 304	0. 330	60	78	0. 402	27. 67	se.	7	36. 1	5	4	Light haze....	5 alto-cumulus; 1 cumulo-stratus.
March 18.																
7:11 a. m..	81. 75	6. 0	8. 05	0. 115	0. 125	42	98	0. 256	27. 78	nw.	1	35. 9	7	4	Light fog	No clouds.
8:31 a. m..	61. 75	21. 9	2. 47	0. 584	0. 635	57	83	0. 387	27. 79	sw.	4	44. 8	8	7	Light haze....	Few fracto-cumulus in south.
9:32 a. m..	46. 50	33. 1	1. 69	0. 706	0. 767	61	74	0. 402	27. 79	sw.	4	44. 2	8	8	....do	Few cumulus.
10:34 a. m..	31. 00	42. 4	1. 37	0. 879	0. 946	62	68	0. 373	27. 79	s.	12	38. 0	8	8	....do	3 cumulus.
11:33 a. m..	16. 25	49. 8	1. 22	0. 100	0. 109	63	69	0. 402	27. 79	e.	7	10. 6	8	7	Cloudy	9 cumulo-stratus; shadow with 3d reading.
2:01 p. m..	20. 75	48. 4	1. 24	0. 534	0. 580	65	65	0. 417	27. 77	ne.	7	11. 8	5	6	Partly cloudy.	9 cumulo-stratus; no shadow with 4th reading.
3:33 p. m..	43. 75	31. 4	1. 77	0. 735	0. 799	66	60	0. 387	27. 76	se.	7	15. 2	9	6	....do	9 cumulo-stratus; few cirrus.
5:23 p. m..	71. 25	14. 0	3. 53	0. 374	0. 407	65	61	0. 387	27. 76	se.	10	33. 0	9	4	Light haze	5 cumulo-stratus.
March 23.																
9:32 a. m..	46. 00	34. 2	1. 62	0. 263	0. 286	57	84	0. 387	27. 36	e.	4	6. 4	1	8	Partly cloudy.	1 cirrus; 1 alto-cumulus; 6 cumulo-stratus.
10:32 a. m..	31. 00	44. 8	1. 30	0. 926	1. 007	62	72	0. 387	27. 37	e.	3	41. 2	8	10	Clear	1 cumulus.
11:31 a. m..	16. 25	51. 8	1. 16	0. 988	1. 074	63	70	0. 402	27. 38	ne.	3	40. 6	8	10	....do	Do.
12:32 p. m..	1. 00	55. 1	1. 12	0. 986	1. 072	66	55	0. 347	27. 37	s.	5	43. 4	8	10	....do	Do.
2:14 p. m..	24. 50	48. 3	1. 23	0. 529	0. 575	68	54	0. 360	27. 37	sw.	3	37. 9	9	10	Partly cloudy.	6 cumulus.
3:02 p. m..	36. 50	41. 2	1. 39	0. 925	1. 005	68	61	0. 417	27. 37	se.	5	5. 2	0	9	Clear	Few cirrus; 6 cumulus.
4:03 p. m..	51. 75	30. 5	1. 79	0. 864	0. 939	69	56	0. 402	27. 38	nw.	10	40. 0	8	8	....do	Few cirrus; 4 cumulus.
5:00 p. m..	66. 00	19. 9	2. 67	0. 682	0. 741	68	58	0. 402	27. 39	nw.	9	8. 7	8	8	....do	6 cumulus.
6:01 p. m..	81. 25	7. 6	6. 51	0. 306	0. 333	65	57	0. 347	27. 41	nw.	10	40. 7	8	7	....do	1 cumulus.
March 24.																
7:02 a. m..	83. 50	6. 5	7. 48	0. 026	0. 028	43	93	0. 256	27. 59	n.	20	12. 4	1	8	Cloudy	8 cirrus; 1 alto-stratus; shadow with 3d and 4th readings.
8:35 a. m..	60. 25	24. 8	2. 19	0. 124	0. 135	48	78	0. 256	27. 60	n.	20	38. 3	7	10	....do	7 cirrus.
March 25.																
7:38 a. m..	74. 50	14. 0	3. 75	0. 301	0. 327	36	51	0. 103	27. 69	nw.	24	23. 2	3	10	Partly cloudy.	9 cirro-stratus; few fracto-cumulus.
8:44 a. m..	58. 00	27. 2	2. 02	0. 672	0. 730	39	40	0. 098	27. 70	nw.	24	39. 0	6	10	Clear	7 cirrus.
9:37 a. m..	44. 75	37. 1	1. 54	0. 788	0. 857	40	33	0. 081	27. 70	nw.	20	45. 2	8	10	....do	1 cirrus; near sun.
10:36 a. m..	30. 00	46. 7	1. 27	0. 886	0. 963	42	43	0. 113	27. 70	nw.	20	44. 8	8	10	....do	Few cirrus in south.
11:33 a. m..	15. 75	53. 6	1. 15	0. 908	0. 987	45	36	0. 108	27. 71	nw.	15	43. 2	8	10	....do	Few cirrus in southeast.
12:36 p. m..	0. 00	56. 0	1. 12	0. 877	0. 953	48	35	0. 118	27. 72	nw.	20	43. 5	8	10	....do	No clouds.
2:04 p. m..	22. 00	50. 4	1. 20	0. 887	0. 964	51	34	0. 130	27. 70	nw.	15	43. 6	8	10	....do	Do.
5:03 p. m..	66. 75	19. 9	2. 69	0. 488	0. 530	48	44	0. 150	27. 68	nw.	13	42. 2	8	9	....do	Do.
6:04 p. m..	82. 00	7. 9	6. 32	0. 196	0. 213	46	52	0. 164	27. 70	nw.	12	32. 8	7	8	....do	Do.
March 26.																
7:09 a. m..	81. 50	8. 3	6. 08	0. 272	0. 296	28	93	0. 136	27. 83	n.	3	40. 6	8	10	....do	Do.
8:35 a. m..	60. 00	25. 5	2. 15	0. 658	0. 715	42	65	0. 172	27. 85	n.	1	47. 0	8	10	....do	Do.
10:35 a. m..	30. 00	46. 6	1. 28	0. 858	0. 933	52	45	0. 172	27. 84	nw.	4	47. 2	8	10	....do	Do.
12:33 p. m..	0. 50	56. 3	1. 12	1. 017	1. 105	58	37	0. 180	27. 82	sw.	4	47. 1	8	9	....do	Do.

only object in making a separate entry under this subheading is to indicate whether clouds that could possibly affect the observed radiation covered the sun or not.

Tables 10 and 11 give monthly averages of those pyrheliometer and polarization observations that were taken with a cloudless sky, and of all the observations of relative and absolute humidity, taken at Asheville and Black Mountain, N. C., respectively. The average time at which the pyrheliometer observations were taken is stated at the head of each column.

It will be seen that the radiation was at a maximum in November, and at a minimum in January, and that the observations during the middle of the day at Black Mountain averaged but little higher than those at Asheville for the same hours during the first half of February, although the former were

TABLE 10.—*Monthly averages at Asheville, N. C.*

RADIATION FROM SUN, IN CALORIES (*Q*).

Year and month.	9:10 a. m.	9:40 a. m.	10:50 a. m.	11:38 a. m.	12:37 p. m.	1:37 p. m.	3:06 p. m.	4:06 p. m.	4:30 p. m.	5:02 p. m.	5:41 p. m.
1902.											
Nov.....	.....	0. 891	1. 003	1. 091	1. 093	1. 067	0. 947	0. 729	0. 523	.....	.....
Dec.....	0. 654	0. 746	0. 858	0. 882	0. 948	0. 877	0. 789	0. 549	0. 363	.....	.....
1903.											
Jan.....	0. 495	0. 607	0. 780	0. 846	0. 832	0. 837	0. 685	0. 508	0. 350	0. 229	0. 153
Feb.....	0. 388	0. 661	0. 697	0. 866	0. 985	0. 991	0. 935	0. 725	.....	0. 489	0. 120

PERCENTAGE OF POLARIZATION OF SKY LIGHT (*P*).

1902.											
Dec.....	55. 2	51. 2	50. 8	49. 8	49. 6	49. 9	50. 0	47. 7	40. 6	.....	.....
1903.											
Jan.....	45. 5	46. 5	46. 7	46. 7	43. 6	45. 8	43. 1	40. 8	38. 1	.....	.....
Feb.....	.....	44. 2	44. 6	46. 0	47. 1	47. 2	47. 2	47. 2	.....	43. 2	42. 6

PERCENTAGE OF RELATIVE HUMIDITY OF THE AIR.

Year and month.	9:10 a. m.	9:40 a. m.	10:50 a. m.	11:38 a. m.	12:37 p. m.	1:37 p. m.	3:06 p. m.	4:06 p. m.	4:30 p. m.	5:02 p. m.	5:41 p. m.
1902.											
Nov.....	81	73	66	59	52	50	48	50	57	.....	.....
Dec.....	66	58	50	48	46	40	44	46	50	.....	.....
1903.											
Jan.....	72	68	59	57	55	54	50	48	47	.....	.....
Feb.....	.....	76	63	56	50	44	38	39	.....	37	40

VAPOR TENSION, OR ABSOLUTE HUMIDITY, IN INCHES.

1902.											
Nov.....	0. 249	0. 257	0. 319	0. 322	0. 309	0. 403	0. 305	0. 309	0. 310	.....	.....
Dec.....	0. 110	0. 129	0. 129	0. 146	0. 143	0. 148	0. 165	0. 162	0. 163	.....	.....
1903.											
Jan.....	0. 131	0. 128	0. 131	0. 159	0. 146	0. 149	0. 139	0. 133	0. 124	.....	.....
Feb.....	.....	0. 196	0. 185	0. 205	0. 176	0. 160	0. 157	0. 160	.....	0. 148	0. 160

TABLE 11.—*Averages at Black Mountain, N. C., February 19 to March 26.*

	7:30 a. m.	8:38 a. m.	9:32 a. m.	10:35 a. m.	11:34 a. m.	12:34 p. m.	2:06 p. m.	3:05 p. m.	4:04 p. m.	5:10 p. m.	5:54 p. m.
Radiation.....	0. 200	0. 607	0. 726	0. 893	0. 980	0. 986	0. 911	0. 837	0. 776	0. 473	0. 272
Polarization	37. 6	44. 2	46. 0	46. 2	45. 8	45. 3	45. 8	48. 0	44. 2	43. 7	35. 1
Relative humidity .	90	73	65	65	62	52	52	51	43	51	53
Vaper Tension	0. 146	0. 229	0. 210	0. 210	0. 277	0. 220	0. 252	0. 254	0. 174	0. 205	0. 182

taken at about 200 feet greater elevation, through a clearer atmosphere, and with the sun some 10 degrees higher at noon than were the latter.

The deficiency in the value of Q for January, February, and March, 1903, as compared with the average values for these months during previous years, has been noticed by M. Henri Dufour,[6] at Lausanne, Switzerland, who is inclined to attribute it to increased absorption and reflection of radiation by the atmosphere, due to the presence of volcanic dust. In a letter dated July 9, 1903, the Acting Secretary of the Smithsonian Institution says:

> The observations made here [the astrophysical observatory at Washington] indicate that the drop in the actinometric readings of which you speak is chiefly caused by the increased absorption of the earth's atmosphere during the present calendar year.

The investigation of the cause of this apparent decrease in the amount of solar radiation received at the surface of the earth calls for a special study of the absorption of the atmosphere. While it is difficult to distinguish between cause and effect in this case, it would seem that the general atmospheric conditions suffice to explain the decrease in the value of Q in the observations here presented. During November and the first part of December there were periods of several days of almost cloudless sky. After the middle of December there were few good days until February, and March was almost continuously cloudy until the 23d. When conditions were such that clouds formed readily, particularly in the upper levels, the radiation was small even although clouds might not be visible near the sun. That the radiation is influenced to a greater degree by such conditions than by the surface relative or absolute humidity is easily perceived by an examination of Tables 10 and 11.

It is worthy of note that the polarization of sky light fell off after December, but the relation between radiation and polarization appears to be so complicated that its consideration may well be postponed until more observations have been accumulated. The decrease in the polarization may have been partly due to the fact that as the altitude of the sun above the southern horizon increased from day to day, so the point at which the polarization was measured constantly fell nearer the northern horizon.

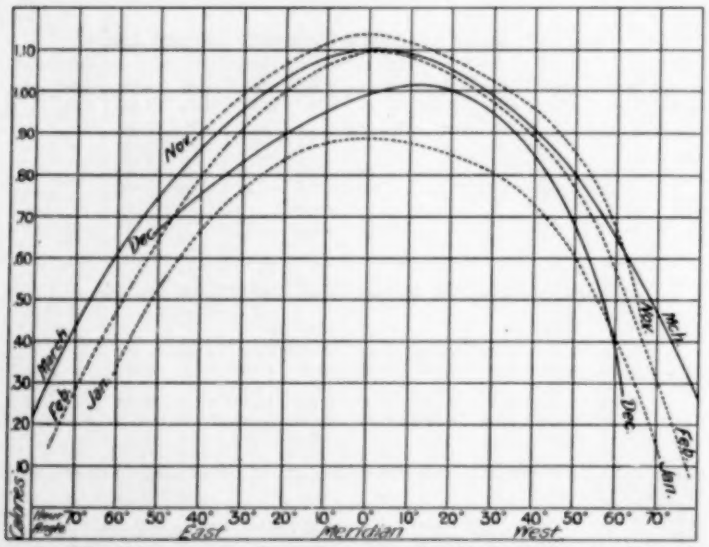


FIG. 2.—Monthly average diurnal curves of radiation with cloudless sky.

The free-hand curves in fig. 2 have been constructed by plotting the pyrheliometer observations taken under the most favorable conditions, with hour angle for abscissas and Q, in calories, for ordinates. They show graphically the same peculiarities in the monthly averages that are seen in Tables 10 and 11.

[6] Paris, Comptes Rendus, March 16, 1903, CXXXVI, pp. 713-715.

In fig. 3 the observations for each station taken under the most favorable conditions have been plotted with the length of path through the atmosphere, or ε, for abscissas and Q for

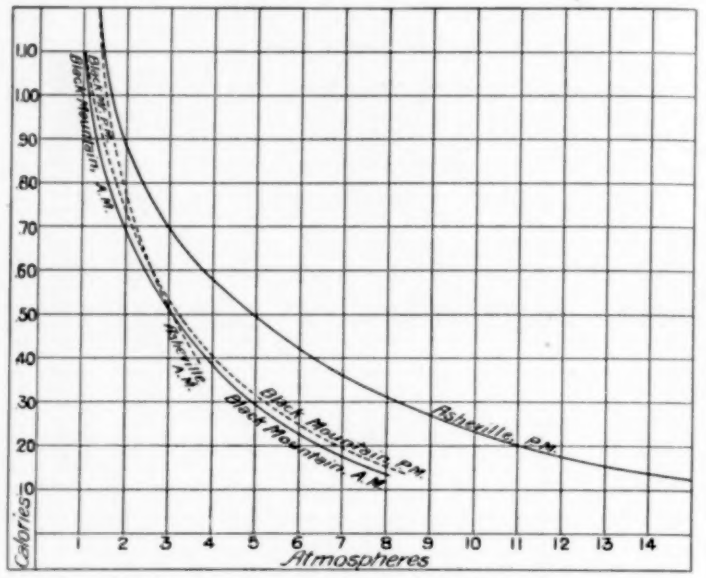


FIG. 3.—Average variation of radiation with ε.

ordinates. In fig. 4 observations for some of the best days have been similarly treated. The curves in both figures show that at Asheville, for equal length of paths through the atmosphere, less radiation was received during the morning than during the afternoon, while at Black Mountain the difference was very slight. No doubt the smoky condition of the atmosphere at Asheville was responsible for the deficiency in the morning radiation. After the lower layers became sufficiently heated to establish convection currents the smoke was carried away, even when the surface wind was light, and the atmosphere was thus made comparatively clear in the afternoon.

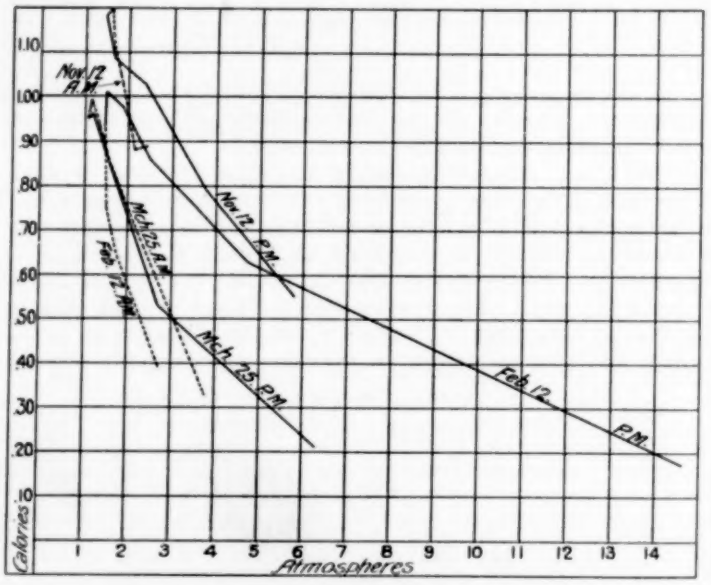


FIG. 4.—Varation of radiation with ε on selected days.

In figs. 5 and 6 are shown characteristic diurnal curves of radiation for different conditions of the sky. November 10, 11, 12, and 13 were quite clear, except that dense haze was recorded on the morning of the 11th and dense smoke on the morning of the 13th. Under these conditions the radiations were depressed to a marked extent, causing wide divergence between the curves for the different dates during the morning

TABLE 12.—*Percentage of polarization of sky light after sunset.*

Date.	Time after sunset (minutes).						Remarks.
	0.	10.	15.	20.	27.	30.	
1902.	%	%	%	%	%	%	
December 11 ...	35.7	51.9	.....	59.6	.....	68.7	Sun set behind clouds; many cirrus observed.
December 13 ...	39.9	53.9	.....	66.2	.....	69.2	Fine cirrus over most of sky.
December 16 ...	45.2	52.0	55.1	56.6	.....	58.8	Clear.
December 17 ...	39.4	50.6	.....	62.3	.....	64.0	Light smoke.
December 18 ...	36.3	44.2	.....	57.0	.....	61.1	Light smoke.
December 23 ...	34.8	41.3	.....	59.4	.....	54.2	Few fracto-cumulus; light haze and smoke.
December 31 ...	37.0	54.1	.....	61.7	.....	64.8	Light haze and smoke.
1903.							
January 6.....	28.5	46.8	.....	57.8	57.2	.....	Cirro-stratus on western horizon.
January 8.....	30.3	42.5	.....	42.1	.....	.....	Cumulo-stratus increased; too dark for later observations.
January 9.....	40.5	54.9	.....	51.5	.....	54.8	Few cirrus; light smoke.
January 12.....	35.1	55.8	.....	59.9	.....	57.1	Brilliant sunset.
January 13.....	36.6	57.8	.....	64.0	.....	67.9	Few cirrus.
January 15.....	34.6	54.6	.....	66.5	.....	67.8	Light smoke.
January 19.....	39.0	56.0	.....	64.5	65.5	.....	Do.
January 22.....	33.9	53.9	.....	64.8	63.2	.....	Few cirrus; light smoke.
January 23.....	39.5	57.7	.....	59.8	56.5	.....	Do.
January 30.....	31.5	57.2	.....	63.9	60.8	.....	Few cirrus; brilliant sunset.
February 4 ...	37.5	58.5	.....	50.5	51.1	.....	Few alto-stratus.
February 5 ...	36.4	55.6	.....	55.1	60.3	.....	9 cirro-stratus; light smoke.
February 9 ...	28.2	49.0	.....	64.4	.....	.....	Few alto-stratus; brilliant sunset.
February 13 ...	47.9	58.9	.....	46.4	54.9	.....	

hours as compared with close agreement during the afternoon hours.

February 12 and 13 were apparently about equally clear, but the radiation curves present marked contrasts, that for the 12th indicating that the atmosphere was clearing throughout the day.

The curves for January 19 and March 3 and 25 are very much flattened during the middle of the day without apparent cause.

On February 25 the sky was overcast all day with cirrus and cirro-stratus clouds, which became so dense that no shadows were cast by sunlight after 4 p. m. A solar halo was observed from 12:30 p. m. to 3:00 p. m.

These results indicate the marked variations in the quantity of heat that is received at the surface of the earth from the sun from day to day, but the observations will no doubt prove of especial value, in conjunction with those made in other parts of the world, for the study of widespread periodic fluctuations

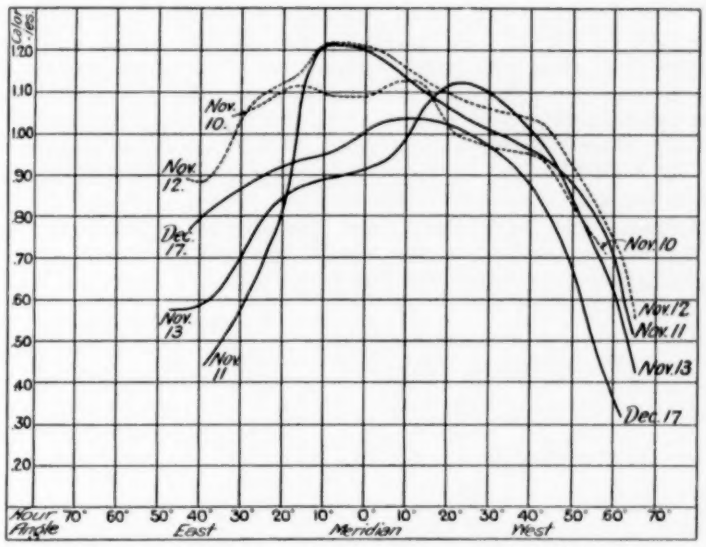


FIG. 5.—Diurnal curves of radiation on selected days.

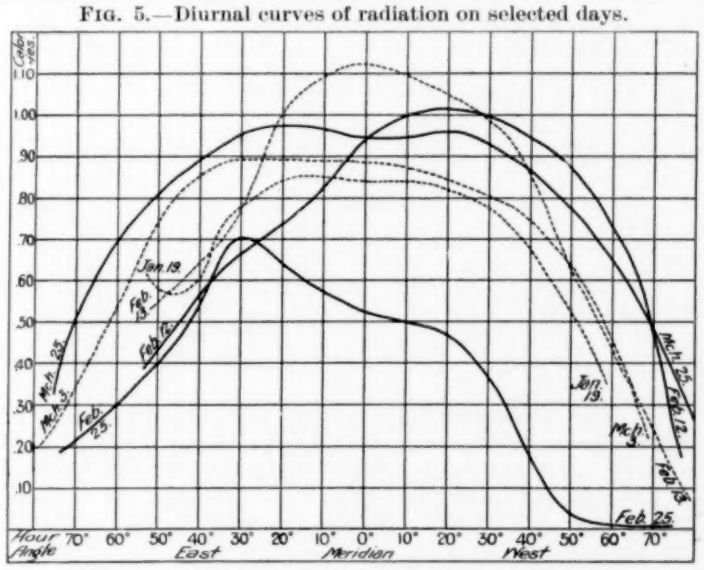


FIG. 6.—Diurnal curves of radiation on selected days.

TABLE 13.—*Percentage of polarization of sky light at points at different distances from sun.*

On vertical circle through sun.

January 6.				January 8.				January 10.				March 25.			
Sun's—		Distances of observed point from sun.	P.	Sun's—		Distances of observed point from sun.	P.	Sun's—		Distances of observed point from sun.	P.	Sun's—		Distances of observed point from sun.	P.
Azimuth.	Altitude.			Azimuth.	Altitude.			Azimuth.	Altitude.			Azimuth.	Altitude.		
°	°	°	*Per cent.*	°	°	°	*Per cent.*	°	°	°	*Per cent.*	°	°	°	*Per cent.*
58.5	0	168.0	− 4.9	.....	.....	.....	.....	51.0	11.0	163.0	− 3.0	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	52.5	8.8	162.7	− 4.0	.....	.....	.....	.....
58.5	0	155.8	− 0.4	59.0	0	154.4	+ 1.9	51.0	11.0	149.0	+ 0.5	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	51.0	9.0	147.0	+ 7.7	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	52.5	8.8	147.7	± 0.0	.....	.....	.....	.....
60.0	−2	139.0	23.0	.....	.....	.....	.....	50.6	11.0	130.0	+11.4	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	329.1	53.9	116.1	33.6
60.1	−2	110.0	46.8	.....	.....	.....	.....	49.5	11.3	110.0	27.4	329.1	53.9	106.1	40.1
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	327.1	53.1	96.9	43.0
60.1	−2	90.0	47.5	.....	.....	.....	.....	.....	.....	.....	.....	316.0	49.0	90.0	44.8
61.7	−3	90.0	57.8	37.9	20.7	90.0	37.8	48.1	13.0	90.0	41.0	317.1	53.1	86.9	42.0
.....	.....	.....	.....	43.0	17.1	80.0	35.4	.....	.....	.....	.....	325.9	52.6	77.4	36.8
.....	.....	.....	.....	42.1	18.1	70.0	25.5	49.5	11.3	70.0	23.1	325.9	52.6	67.4	27.3
.....	.....	.....	.....	41.2	18.4	60.0	17.2	.....	.....	.....	.....	324.0	52.1	57.9	17.4
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	324.0	52.1	47.9	9.8
.....	.....	.....	.....	40.2	19.0	40.0	5.0	.....	.....	.....	.....	322.3	51.7	38.3	4.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	322.3	51.7	28.3	+2.1
.....	.....	.....	.....	39.6	19.2	18.8	0.1	.....	.....	.....	.....	320.9	50.8	19.2	−0.9
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	320.9	50.8	9.2	+0.3
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	317.5	49.8	− 9.8	−0.8
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	317.5	49.8	−19.8	+0.4
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	319.0	50.2	−30.2	+1.1
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	319.0	50.2	−40.2	+5.9

of this character and their relations to weather changes. A long series of such observations should also be of value in connection with the study of the effect of weather conditions upon crop growth. The results thus far obtained are therefore published at this time without further discussion.

The observations on the polarization of sky light after sunset in Table 12, and on the polarization at different distances from the sun, in Tables 13 and 14 are still to be added. In general, it was found that when the sunset colors were brilliant and extended to the zenith the polarization was less than on evenings when the colors were not so pronounced.

Since the Pickering polarimeter is not well adapted to measuring the polarization when at a minimum, the position of the neutral points of Arago, Brewster, and Babinet could not be accurately determined. The observations of January 6 and 8 indicate that the position of Arago's neutral point was about 25° above the antisolar point, while those of January 10 indicate that it was about 30° above, but these observations in connection with those of February 24 and March 3 and 25 indicate the presence of neutral belts rather than of neutral points.

TABLE 14.—*Percentage of polarization of sky light at points at different distances from sun.*

On horizontal circle passing through sun.				On horizontal circle passing through point of maximum polarization.			
February 24.				March 3.			
Sun's—		Azimuth from sun.	P.	Sun's—		Azimuth from sun.	P.
Azimuth.	Altitude.			Azimuth.	Altitude.		
°	°	°	*Per cent.*	°	°	°	*Per cent.*
				307.1	30.9	0	+ 1.6
310.0	30.2	20	+ 1.5	307.1	30.9	20	+ 2.0
310.0	30.2	40	− 1.7	309.1	32.0	40	± 0.0
311.0	30.7	60	−12.0	309.1	32.0	60	− 1.0
311.0	30.7	80	−19.5	312.0	33.2	80	−17.4
312.9	32.1	100	−22.1	312.0	33.2	100	−18.3
312.9	32.1	120	−11.5	313.7	34.5	120	− 6.4
314.4	33.0	140	+ 9.5	313.7	34.5	140	+13.4
314.4	33.0	160	+24.0	314.5	35.8	160	+40.5
316.0	34.0	180	+34.0	314.5	35.8	180	+45.9
316.0	34.0	200	+30.3	322.6	39.8	200	+42.1
325.0	38.2	220	+26.5	322.6	39.8	220	+25.9
325.0	38.2	240	+ 4.4	325.1	40.3	240	+ 4.9
326.9	39.0	260	− 8.8	325.1	40.3	260	− 7.5
326.9	39.0	280	−12.6	327.3	41.0	280	−12.2
328.3	39.5	300	− 8.9	327.3	41.0	300	− 8.0
328.3	39.5	320	− 5.2	328.2	41.7	320	− 1.9
330.1	40.0	340	− 2.0	328.2	41.7	340	+ 0.9
Maximum polarization			43.3				

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that Island, we have received the following table in advance of the regular monthly weather report for Jamaica:

Comparative table of rainfall for July, 1903.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1903.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	24	4.42	8.19
Northern division	22	53	2.20	3.23
West-central division	26	26	7.79	8.19
Southern division	27	36	2.78	4.36
Means	100	139	4.30	5.99

The rainfall for July was therefore below the average for the whole Island. The heaviest fall was 18.08 inches at Kings Valley in the west-central division; while no rain fell at Irish Town in the northeastern division or at Richmond Pen in the northern division.

RECENT PAPERS BEARING ON METEOROLOGY.

Dr. W. F. R. PHILLIPS, Librarian, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Science. New York. N. S. Vol. 18.

Ward, R. DeC. The Climate of Benguet, Philippine Islands. [Note.] Pp. 90–91.

Ward, R. DeC. The Recent Floods. [Note.] P. 91.

Ward, R. DeC. Rainfall and Sunspots. [Review of article by W. J. S. Lockyer.] Pp. 91–92.

Rotch, A. Lawrence. Meteorological Observations with Kites at Sea. Pp. 113–114.

Ward, R. DeC. Climate and Crops in the Argentine Republic. [Review of article by J. Russell Smith.] Pp. 154–155.

Ward, R. DeC. Kite-flying in Scotland and the Cyclone Theory. [Note on article by W. H. Dines.] P. 155.

Ward, R. DeC. Carbon Dioxide in London Railway Carriages. [Note.] P. 155.

Ward, R. DeC. Health on the Isthmus of Panama. [Review of article by Henry L. Abbot.] P. 185.

Scientific American Supplement. New York. Vol. 56.

Guarini, Emile. A Method for the Study of Storms. P. 23065.

Nature. London. Vol. 68.

Wilson, W. E. Radium and Solar Energy. P. 222.

Thorpe, T. E. "Red Rain" and the Dust Storm of February 22. Pp. 222–223.

Marshall, P. Dust Storms in New Zealand. P. 223.

Shaw, W. N. The Thunderstorm of May 31. P. 247.

Lockyer, William, J. S. On a Probable Relationship between the Solar prominences and Corona. Pp. 257–259.

Lagrange, Ch. The Source of Radium Energy. P. 269.

Lockyer, William J. S. A Multiple Lightning Flash. P. 270.

Bianco, Ottavio Zanotti. The Moon's Phases and Thunderstorms. P. 296.

Boys, C. V. The Passage of Sound through the Atmosphere. Pp. 145–150.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 29.

Brodie, Frederick J. The Prevalence of Gales on the Coasts of the British Islands during the 30 years 1871–1900. Pp. 151–171.

Dines, W. H. Formation of Cumulus Cloud. [Reprint from Symons's Meteorological Magazine.] P. 179.

—— Shrinkage of the Thames and Lea. [Review of Report by Mr. Fitzmaurice.] Pp. 179–180.

Baxendell, Joseph. Note on the Duration of Rainfall. Pp. 181–185.
—— Local Factors influencing Climate. [Review of Article by C. W. Buckley.] P. 188.
Marriott, William. Greatest Variations of Temperature. Pp. 222–223.
Bentley, W. A. Snow Crystals. [Extract from paper by W. A. Bentley.] Pp. 223–224.
—— Egyptian Meteorology. [Note.] P. 224.
—— Climate of Alexandria. [Summary of meteorological observations.] P. 224.
—— Climate of the East Protectorate. [Review of paper by R. B. Buckley.] Pp. 224–226.

Symons's Meteorological Magazine. London. Vol. 38.
—— The Rainfall of June, 1903. Pp. 93–99.
Wheeler, W. H. Rainfall in the Lincolnshire Fens, from records kept at Boston. Pp. 99–100.
Ellis, William. Cloud Estimation. Pp. 101–102.
Single, Stanley. Grass and Shade Minima on a hill and in a valley. P. 102.

Bulletin of the American Geographical Society. New York. Vol. 35.
Eisen, Gustav. Notes during a Journey in Guatemala, March-December, 1902. Pp. 231–252.
Tower, Walter S. The Climate of the Philippines. Pp. 253–260.
Ward, R. DeC. Climatic Control of Railroad Construction and Operation. [Review of article by Robert M. Brown.] Pp. 269–270.
Ward, R. DeC. London Fogs. Pp. 270–271.

Aëronautical Journal. London. Vol. 7.
—— The Wind Forces overcome in the Experiments of M. Santos Dumont with his Navigable Balloon in Paris 1901. Pp. 49–53.
Blackden, L. S. Experiments relative to Equilibrium and Angle of Fall in Gliding Flight. Pp. 53–61.

Knowledge. London. Vol. 26.
McPherson, J. G. Murray and Chrystal on "Seiches." P. 172.
Bell, Arthur H. Wireless Telegraphy and Weather Forecasting. Pp. 172–174.

London, Edinburgh, and Dublin Philosophical Magazine. London. Series A. Vol. 201.
Carr, W. R. On the Laws governing Electric Discharges in Gases at Low Pressures. Pp. 403–433.

Proceedings of the Royal Society. London. Vol. 72.
Shaw, W. N. Meteorological Observations obtained by the Use of Kites off the West Coast of Scotland, 1902. Pp. 13–15.
Chree, Charles. An Analysis of the Results from the Kew Magnetographs on Quiet Days during the Eleven Years 1890–1900, with a Discussion of certain Phenomena in the Absolute Observations. Pp. 22–24.
Perman, Edgar Philip. The Evaporation of Water in a Current of Air. Pp. 72–83.

National Geographical Magazine. Washington. Vol. 14.
Mosely, E. L. Rainfall and the Level of Lake Erie. Pp. 327–328.

Popular Science Monthly. New York. Vol. 63.
Lodge, Oliver. Modern Views on Matter. Pp. 289–303.

Ciel et Terre. Bruxelles. 24me année.
L., V. D. La répartition de l'insolation en Allemagne. Pp. 267–277.

Annuaire de la Société Météorologique de France. Paris. 51me année.
Angot, Alfred. Sur les variations simultanées des taches solaires et des températures terrestres. Pp. 93–97.
Launay, F. et Maillet, E. Sur le débit probable des sources pendant la saison chaude de 1903 (1er mai, 1er novembre). Pp. 97–98.
Garrigou-Lagrange, P. Sur la cinématographie des mouvements atmosphériques. Pp. 102–106.
Cœurdevache, P. Pluie à Paris suivant le cycle lunaire. Pp. 106–107.
Goutereau, Ch. La pluie dans le département des Pyrénées-Orientales pendant 50 ans (1851–1900) d'après M. le Dr. Fines. Pp. 109–116.
Moureau, Th. Sur les refroidissements et les réchauffements de la température en juin. Pp. 117–118.
Goutereau, Ch. La circulation générale de l'atmosphère, d'après M. Hildebrandsson. P. 118–120.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 136.
Nordmann, Charles. La période des taches solaires et les variations des températures moyennes annuelles de la terre. Pp. 1047–1050.
Esclangon, —. Sur les lueurs crépusculaires observées à Bordeaux pendant l'hiver 1902–1903. Pp. 1050–1052.
Meunier, Stanislas. Pluie de poussière récemment observée en Islande. Pp. 1713–1714.
Eiffel, G. Expériences sur la résistance de l'air. Pp. 30–32.
Thoulet, J. Étude de la circulation marine. Pp. 97–98.

La Nature. Paris. 31me Année.
P[arville], H[enri] de. Le cycle solaire et météorologique de trente-cinq ans. Pp. 86–87.
Plumandon, J. R. La neige selon l'altitude. Pp. 92–93.

Journal de Physique. Paris. 4me séries. Tome 2.
Blondlot, R. Sur l'existence de radiation solaires capables de traverser les métaux, le bois, etc. Pp. 551–553.

Archives des Sciences Physiques et Naturelles. Genève. 4me période. Tome 16.
Finsterwalder, S. and Muret, E. Les variations périodiques des glaciers. VIIme rapport, 1902, rédigé au nom de la Commission internationale des glaciers. Pp. 86–104.

Gaea. Leipzig. 39 Jahrgang.
Klein, —. Sonnenflecken, barometrische Depressionen und Niederschläge. Pp. 467–472.
—— Der Staubfall vom 9. bis 12. März 1901. Pp. 472–482.
—— Die gegenwärtige Entwickelung der Luftschiffahrt. Pp. 494–499.

Petermann's Mittheilungen. Gotha. Band 49.
Eichhorn, Aug. Entwurf einer Sonnenscheindauer-Karte für Deutschland. Pp. 102–109.
Hann, Julius. Die Temperatur von Callao. Pp. 109–110.

Physikalische Zeitschrift. Leipzig. 4 Jahrgang.
Kaufmann, W. Glimmentladung bei Atmosphärendruck. Pp. 578–580.

Das Wetter. Berlin. 20 Jahrgang.
Polis, P. Der Gewittersturm vom 26. Juli 1902 in der Rheinprovinz. Pp. 145–158.
Ziegra, Alfred. Untersuchung der "Nachtfrostprognose nach Kammermann" für mehrere meteorologische Stationen Nord und Mitteldeutschlands. Pp. 158–162.
Henze, H. Ueber den wirtschaftlichen Wert des Wetter-Bureaus. Pp. 164–165.

Annalen der Physik. Leipzig. Vierte Folge. Band 12.
Riecke, Eduard. Beiträge zu der Lehre von der Luftelektrizität. Pp. 52–84.
Himstedt, F. Ueber die Ionisierung der Luft durch wasser. Pp. 107–123.
Bleekrode, L. Ueber einige Versuche mit flüssiger Luft. Pp. 218–223.

Zeitschrift der Gesellschaft für Erdkunde. Berlin. No. 4, 1902.
Ule, W. Beziehungen zwischen Niederschlag und Abfluss in Mittel-Europa. Pp. 280–297.

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Wien. 111 Band.
Hann, J. Zur Meteorologie des äquators. Nach den Beobachtungen am Museum Goeldi in Pará. Pp. 615–683.
Exner, F. M. Versuch einer Berechnung der Luftdruckänderungen von einem Tage zum nächsten. Pp. 707–725
Valentin, J. Staubfall vom 9. bis März 1901. Pp. 727–776.
Elster, J. und Geitel, H. Messungen der Elektricitätszerstreuung in der freien Luft. Pp. 946–981.
Hann, J. Ueber die tägliche Drehung der mittleren Windrichtung und über eine Oscillation der Luftmassen von halbtägiger Periode auf Berggipfeln von 2 bis 4 km. Seehöhe. Pp. 1615–1711.

Meteorologische Zeitschrift. Wien. Band 20.
Mack, K. Morphologie der Wolken des aufsteigenden Luftstroms. Pp. 289–307.
Drapczynsky, V. Ueber die Verteilung der meteorologischen Elemente in der Umbegung der Barometer-Minima und Maxima zu St. Louis in Missouri, Vereinigte Staaten von Nordamerika. Pp. 307–315.
—— A. F. Osler. P. 315.
Prohaska, K. Ueber Blitzschäden und bemerkenswerte Entladungsformen der atmosphärischen Elektrizität im Jahr 1901. Pp. 315–317.
Wolfer, A. Provisorische Sonnenflecken-Relativzahlen. P. 317.
Busch, —. Beobachtungen über die gegenwärtig vorliegende Störung der atmosphärischen Polarisation. Pp. 317–319.
—— Zum Klima von Catania. Pp. 319–320.
H[ann], J[ulius]. Die periode der Sonnenflecken und die Variationen der mittleren Jahrestemperatur an der Erdoberfläche. Pp. 320–321.
Gockel, Albert. Luftelektrische Untersuchungen. Pp. 321–322.
Köppen, W. Bericht über die Erforschung der freien Atmosphäre mit Hilfe von Drachen. Pp. 322–323.
Wachenheim, H. Zum Klima von New York. Pp. 323–328.
Gockel, A. Atmosphärische Trübung im Winter und Frühling 1902–1903. P. 328.
—— Staubfall im Februar 1903. P. 328.
—— Gewitter und heftige Regengüsse zu Pfingsten um London. P. 329.
Mülbe, —. und Freunthaller, —. Meteor am 31. Mai. P. 329.
—— Resultate der meteorologischen Beobachtungen in Santiago de Chile 1888–1891. Pp. 329–331.
—— Klimatabelle für Santiago de Chile. P. 331.
—— Luftelektrische Messungen auf dem Gipfel des Montblanc. Pp. 331–332.

—— Ueber den Ursprung des Wortes "Barometer." Pp. 332–333.
—— Resultate meteorologischer Beobachtungen zu Hanoi (Tonkin). Pp. 333.

Memorie della Società degli Spettroscopista Italiana. Catania. Vol. 32.
Ricco, A. Le protuberanze solari nell' ultimo periodo undecennale. Pp. 157–162.

Wiener Luftschiffer-Zeitung. Wien. 2 Jahrgang.
—— 7280 Meter hoch. Ein neuer Weltrekord mit dem 1200 Kubik-Meter-Ballon. Ergebnisse der internationalen Ballonfahrt vom 4. Juni 1903. Pp. 137–138.

Hemel en Dampkring. Amsterdam. Augustus 1903.
Linden, H. v. d. Iriseerende wolken. Pp. 248–253.

NOTES AND EXTRACTS.

THE "GUNS" OF LAKE SENECA, N. Y.

In the MONTHLY WEATHER REVIEW for September, 1897, page 393, we have given some account of the "barisal guns," the "mistpouffers," and similar phenomena whose origin is as yet not certainly understood. The following letter describes an analogous phenomenon in Seneca Lake, N. Y., and it may well be that the barisal guns have their origin in the escape of bubbles of gas just as do the "guns" of Seneca Lake.

Mr. Wm. A. Prosser, of Dresden, Yates County, N. Y., writes as follows, under date of August 18, 1903.

So far as I am personally concerned I know of no explosions of inflammable gas, and the newspaper stories are fabrications in this respect.

The "lake guns" are evidently caused by gas escaping from the sand at the bottom.

Long Point is situated about 15 miles south of Geneva, N. Y., and about 25 miles north of Watkins, N. Y., on the west side of Seneca Lake. Directly off the Point the water is very deep. Heavy currents pass either north or south at regular intervals. A heavy wind for a few hours will change the position of the extreme end of land (which extends 1½ miles eastward) several rods. When the swell is not too heavy you can always see the gas rising in bubble form, which, as a rule, makes very little noise, but larger eructations evidently produce these "lake guns." The sand would not stay in place were it not for the water holding it there at the extreme point. Large steamers can land there with but the aid of an ordinary gang plank.

I do not know that the gas is inflammable, but I could easily ascertain if it is of any special interest to you. Natural gas is found in considerable quantity within 3 or 4 miles of the point, on the outlet of Keuka Lake, but hardly in paying quantities. However, I am told that a company has been formed that will exploit the gas along the outlet, but not at the Point.

VARIATION OF GRAVITY OVER THE DEEP SEA.

The last annual report, 1902–3, of Professor Helmert, as Director of the Royal Geodetic Institute of Prussia, mentions the result of the work of Professor Dr. Hecker on the measurement of gravity on the open ocean by the comparison of two methods of determining atmospheric pressure, viz, the observation of the mercurial barometer whose records are affected by gravity, and the determination of pressure by the use of the boiling point thermometer, whose indications are not affected by the variation of gravity. Of course, the aneroid barometer could be used instead of the thermometer, but it is not considered to be so reliable. In fact the temperature of the boiling point can not be determined with sufficient accuracy unless every known source of error is most carefully investigated. Professor Hecker's revised computations give the following results: The excess of pressure shown by a mercurial barometer over the pressure shown by the thermohypsometer, is greater when sailing over the shallow part of the ocean than when sailing over the deep sea between Lisbon and Rio Janeiro. On the voyage southward this excess expressed in millimeters of the mercurial column was $+ 0.017^{mm} \pm 0.015^{mm}$; on the return voyage northward the excess was $+ 0.048^{mm} \pm 0.034^{mm}$. Combining these two results into one average and converting that from millimeters of barometric pressure into centimeters per second, as the unit of the force of gravity, Professor Hecker's observations show that in general, in this part of the ocean, gravity over shallow seas is greater than that over the deep sea by $+ 0.028^{cm} \pm 0.018^{cm}$. The standard force of gravity is 980.6 centimeters per second, so that the diminution over the deep sea is about 0.00003 of gravity, or 3/1000 of one per cent of its full value. From a geographic point of view this result seems to confirm the isostatic hypothesis of Pratt as to the elevations and depressions on the earth's surface. From a meteorological standpoint we see that this change in the force of gravity, as we sail over the ocean, can have but very little influence on the motions of the atmosphere. It is, in fact, of the same order of importance as the gaseous viscosity of the atmosphere, which is sometimes introduced into the equations of motion as friction, but which can be neglected in comparison with the great resistances offered by land *versus* water, mountains *versus* plains, vortical *versus* rectilinear currents, and the mixture of slow moving lower air with rapidly moving upper strata.

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. Charles Stewart, Observer, Spokane, Wash., under date of July 9, reports visits from schools and teachers as follows:

January 22, 1903.—The class in physical geography of the Spokane High School.
March 28.—The pupils and teachers of the Holmes Grammar School.
April 10.—A number of the teachers attending the Teachers' Institute.
April 11.—A second visit from the members of the Teachers' Institute.
April 20.—The first section of the class in physical geography of the Spokane High School.
April 24.—The second section of this class.
In all cases the instruments and methods of the Weather Bureau and the determination of atmospheric moisture by the whirled psychrometer were fully explained. These visits and explanations are highly appreciated by the community.

THE DROUGHTS OF 1901-3.

The distressing drought in Australia has been relieved in many localities but in others it still continues. Mr. Andrew Noble, of Rozelle, near Sydney, New South Wales, calls attention to the fact that we must study the origin or cause of this drought in connection with antarctic conditions "as bringing about a variation in pressure distribution favorable to drought." The following is an extract from his letter of July 4, 1903:

The late drought has had such far-reaching effects in both hemispheres, as shown by the famine in India and Russia,[1] the lowness of the Nile inundations,[2] and the drought in England,[3] that the student will need to look further and deeper for the solution of the whole problem, and your article on the "Physical basis of long-range weather forecasting (MONTHLY WEATHER REVIEW, December, 1901) shows what a complex problem that is. Dealing with the subject as it seems to affect Australia we find that anticyclones are the controlling force[4] determining our weather, that they are characterized by a steady eastward motion, and that their normal path varies with the sun's apparent journey north and south.

The cyclone only occasionally reaches a full development in our latitude, its place being generally supplied by the V-shaped depression, which remains more or less upright [i. e., capital V with its apex south] if it comes on to our mainland from the Tropics, but inverted [i. e., a capital Λ with apex north] when it approaches us from the southern

[1] The Russian government has to face the problem of feeding 15,000,000 hungry peasants scattered over central and eastern Russia and partly in the southeast and along the Volga; £200,000 worth of rye has been sent out, and the government has bought an additional £1,500,000 worth of rye and wheat for the same purposse. Cattle are dying by the thousand. (Despatch from St. Petersburg, dated December 27, 1902, reproduced in Sydney Daily Telegraph of February 16, 1903.)

[2] The annual inundation of the Nile has taken place and the flood is the lowest that has ever been recorded. (Cablegram in Sydney Daily Telegraph of August 7, 1902.)

[3] This is the seventh year in which metropolitan rainfall has been less than the average. Such a prolonged period of drought is not recorded since 1845. (English Mechanic, December 13, 1901.)

[4] Vide Russell in Quar. Jour. Roy. Met. Soc., Vol. XIX, No. 85, January, 1893.

ocean. These depressions generally bring what rain is deposited in Australia, and their intensity seems to depend largely upon the energy of the anticyclone which controls their eastward motion. Even in time of drought the currents circulating around these depressions are not always dry; cloudy skies sometimes giving a drop or two of rain, and recurring day after day at certain inland stations, form a peculiar feature during our monsoon period, but during such dry periods adjacent anticyclones are always more or less inactive. Amid all the variations of pressure distribution during the late prolonged drought two types seem to have been especially pronounced, i. e., (1) a succession of extensive and close-moving anticyclones during the winter months; (2) long and shallow barometric gradients during the monsoon period; the latter were very noticeable during the summer of 1899–1900, and Mr. Wragge, in his almanac for 1901, supplies a chart where the range, over a distance of approximately 3000 miles, from center of depression to center of anticyclone, does not exceed three-tenths of an inch. Both these types seem to be unfavorable for useful rains; the first, or winter type, will not allow rain-bearing depressions to penetrate to the mainland, and the second, or summer type, is generally associated with irregular or indefinite monsoonal depressions in which thunderstorms sometimes give rise to more or less sporadic rains. Inland local whirlwinds have formed another special feature during the late drought, and tornadoes also seem to have been more prevalent during long dry periods, although owing to our comparatively sparse settlement the effect produced by the latter is not always so disastrous as in the United States of America.

It would be interesting to know whether variation in the antarctic ice limit really has any effect upon our seasons, but it would probably take a long record to prove or disprove this theory. It is a remarkable fact that at the commencement of our late prolonged drought, i. e., 1895, icebergs were unusually prevalent in the southern ocean. Allingham[5] writes: "During the four years, 1892–1895, the height, area, and numbers of icebergs in the southern ocean probably exceeded all previous records." During this period bergs were met with 600 miles beyond the usual limit.

Mr. Russell's two papers[6] supply ample evidence as to numerous bergs appearing far beyond the limit set down on the Admiralty Ice Charts; in the first paper he writes: "We have had within the last two years an extraordinary accession of icebergs between the Cape of Good Hope and Australia." One is surely safe in assuming that the recorded number of bergs represents only a mere fraction of those floating in still higher latitudes, and that the amount of ice freed from the antarctic sheet must have been very unusual during these years. Now the melting of this ice must have a marked effect upon the temperature of the water and consequently on the air pressure above the water in these latitudes, and as the compensation principle is always working, the intensity of pressure over Australia would propably be indirectly affected. This view seems to be supported by the researches of H. N. Dickson,[7] and his suggestion is even more applicable to the Southern Hemisphere, because the antarctic ice cap is infinitely larger. It remains to future investigation to show what the effect on our seasons really is, but it may operate in two ways, i. e., to cause a variation in the distribution of pressure over Australia, or, other conditions being favorable, to assist toward a partial displacement in the paths followed by anticyclones. We have an example as to what such displacement might mean in the short but memorable drought of 1888. At the end of that year Mr. Ellery, then government astronomer of Victoria,[8] said: "The present dry season may be explained by the fact that the northwest monsoons have come very far south, and have forced off the region of high pressure which usually lies over the southern portion of Australia." Referring to Australian droughts in general Mr. Russell said: "The real cause is a variation in the position of the monsoonal winds or dry wind belt."

In studying this important and fascinating subject, one must be careful not to confound cause and effect. Thus, consider the fact that unusually cold west or southwest winds bring icebergs unusually far northward into the south Indian Ocean. Such cool winds, when they flow over land areas, grow warmer and drier as they approach the equator, and are therefore intrinsically less favorable to production of rain. If they flow over snow or ice or water they become moister and in general also warmer. We see no important causal connection between the ice and the drought. Similarly, in the Northern Hemisphere, the cold, dry, northerly winds blow from the ice and snow of the arctic regions, and we get light rain from such winds when they are forced up over mountains; we get heavy rain from them only when they underrun, lift up, and mix with warm, moist air coming from equatorial regions, and even then we attribute the rain to the equatorial winds, as these contribute most of the moisture. If we follow the equatorial winds, whether at sea level or in the upper strata, we find them cooling as they proceed poleward, forming rain or snow, cloud, and fog. Eventually they must return from the polar regions as cold, dry winds. They leave their moisture behind in the shape of snow and ice, icebergs and icefloes; blowing past these, they come to us as very cold winds, generally far colder than the mass of snow and ice they have left behind. They owe their low temperature to the direct radiation of heat from the hazy, dusty air itself; to the loss of a little heat given by conduction to the cold surfaces of ice, snow, and frozen ground, and to the evaporation of a little water at low temperatures from these icy surfaces. They owe their dryness not only to the fact that the air is usually descending on a gentle gradient to the ground, warming up dynamically, but also to the fact that the air is moving into warmer latitudes, where the sun has more power. The conduction of heat from beneath the surface of the ground to the air is too slow a process to be important, although often so referred to; it is the solar heat returning from the surfaces of the ground and clouds and ocean and the evaporation from these surfaces that are the important processes in warming the atmosphere.

We do not think it proper to say "the melting of this ice must have a marked effect upon the temperature of this water and consequently on the air pressure above the water." The ice melts by absorbing heat from the surrounding sea water, from the sun, and from the air; the process tends to keep both sea water, ice water, and air near the temperature of 32° F. until all the ice is melted. The resulting fog or saturated air at 32° F. is more favorable to rain than the original dry air at the same temperature. We do not see how the temperature of the free air can directly affect its barometric pressure. In general the temperature of the free air does not affect its barometric pressure directly; pressure is not dependent on the density of the air, but, on the contrary, temperature and pressure control the density. If cold winds replace warm winds, we expect the barometer to rise. This is the usual sequence, but it is not the cold that has caused the higher pressure; there are several intervening considerations. Either there must be more air above the barometer, so that the latter indicates an increase in pressure due to increased weight, or else there must be a movement of the air, or a change in movement, or a stoppage, so that the barometer indicates increased pressure as a dynamic effect. The barometer measures atmospheric pressures that are determined by various different processes, all of which are usually found combined in various proportions in meteorological phenomena. In no case is it proper to say that the barometer rises simply because cold air is denser than warm air; the same quantity of air will weigh the same no matter what its temperature or pressure or density. The elastic pressure within a mass of free air, as measured by a barometer, depends on all the conditions surrounding that air and keeping it in place.

The interesting collocation of droughts mentioned by Mr. Noble may be restated thus:

1. Unusual prevalence of icebergs in the southern Indian Ocean during 1892–1895.
2. Deficient rain in England for seven years, culminating in 1901.
3. Deficient rain in Australia since 1895, culminating in 1903.
4. Deficient rain in the watershed of the Nile in the spring of 1902.
5. Deficient rain in central and eastern Russia in the summer of 1902.

Droughts must be studied by first examining the general movement of the air. Dry air is due to the descent of upper strata to the ground, or to the movement of polar air equatorward. Both of these are phenomena of descending currents, but they imply ascending currents elsewhere, and generally

[5] Marine Meteorology, 1900.
[6] Roy. Soc. of N. S. Wales, September 4, 1895, and October 6, 1897.
[7] Quart. Jour. Roy. Met. Soc. Vol. XXVII, No. 119, July 1901, p. 193.
[8] Sydney Daily Telegraph, December 29, 1888.

we find an excess of cloud and rain on the equatorial sides of the respective localities where droughts occur.

The Annual Report for 1901 of the Meteorological Commission of Cape Colony shows that in general, over South Africa, the rainfall of 1901 was normal or above, the excess being decidedly large in September and October. Did this excess continue over into the spring of 1902 when the watershed of the Nile had a deficiency? The deficits of 1901 and 1902 in England and Russia were accompanied by excess in parts of the Mediterranean basin.

It may be anticipated that, in general, the areas of excess of rainfall that accompany and really result from the conditions that cause a given area of deficiency will develop at irregular times and places depending on favorable local circumstances, although, in general, subsequent to and on the equatorial sides of the droughty regions.

Thus an unusual movement of ice northward into the south Indian Ocean, due to an unusual southerly component of the wind in that region brings excess of rain to South Africa. But this unusual southerly component over the Indian Ocean, or this outflow from the Antarctic, must be accompanied by either a corresponding northerly component in some higher stratum above this region, or an unusual flow in the lowest stratum from the equator over some other region, possibly on the opposite side of the Antarctic Circle, and this latter would bring about an unusual rain and snow on that side of the antarctic region. As there is a large part of the ocean from which we rarely receive any meteorological information, it is not surprising that we are not yet able to elucidate all the intricacies of the geographic distribution of the areas of excess and deficit of precipitation. Already the Australian drought has been generally succeeded by bountiful rains in many districts and droughty conditions are passing away.

THE RAIN MAKER IN AUSTRALIA.

In connection with the droughts in Australia we have received abundant details of the efforts made to force rain from the unwilling clouds.

At a meeting of the Chamber of Commerce of Broken Hill, Thursday, July 2, the mayor submitted the formula given by Mr. A. J. J. Phelps, of Sydney, and his method was indorsed by several. The formula consists in using sulphuric acid and zinc, the hydrogen set free ascends with aqueous vapor "in spiral columns which are hollow when they reach the rain belt in the atmosphere, and the cold air in that region rushes down to the warmer air below."

Any one can try this simple well-known chemical experiment for making hydrogen, but we have every assurance that no rain will result and no cold air will rush down and no rain belt will be found in the atmosphere. This, in fact, was the experience of Mr. Allen and the Australian committee at Stephens Creek, which reported that "the experiments were not successful, owing to there being rather too much wind to allow the column of gas to ascend perpendicularly."

The failure of Mr. Allen was complete; the excuse was quite unphilosophical and unnecessary.

Previous to Mr. Allen's *fiasco*, a much more imposing attempt had been made by Dr. C. DeLacy McCarthy, who is said to be "a graduate of Trinity College, Dublin, and who spoke with the utmost confidence on the question of the production of rain, saying: 'I will start to work on Wednesday, and you will have rain by Saturday.'"

The Government of South Australia, the Chamber of Commerce, and the water companies of Broken Hill had united in bearing the expense of a special train to bring Dr. McCarthy and five assistants and apparatus from Petersburg. He did not wish the details of his method known except that in general—

He forces chemical fumes into the air for a great distance which create a vacuum in the fourth, fifth, and sixth strata of air. The center of a heat storm is thus formed and the cold air descends, resulting in a heavy tropical rain. The secret of the chemicals was given him by a man in America. He had improved on the system with the aid of a clever Japanese chemist. He changes his methods to suit varying conditions. It may require thirty-two hours of continous work to achieve success. He produced rain in twenty-two hours in Victoria.

Dr. McCarthy delayed three days before beginning; meantime the sky clouded over and predictions were received from Mr. Barrachi, Director of the Meteorological Office, at Melbourne, forecasting rain within three days. McCarthy's experiments began on Wednesday, a furious dust storm prevailed with northwest winds; although the wind and dust were distressing, he announced that "the vacuum is working still far up." But the wind veered to the south and all chance of the predicted rain from the west seemed to disappear. Eventually, "on July 3, Dr. McCarthy suspended operations, saying that conditions were all against him." He expected to resume when favorable predictions should be published by the Meteorological Office.

A few days before this Mr. Rutter, with several local chemists, "Had sent up a column of hydrogen which was followed by clouds and light rain, and they felt certain that a heavy downpour would have resulted had they continued their efforts." Probably, they realized that the clouds and light rain really had nothing to do with their hydrogen gas.

In their extremity the Broken Hill people naturally clutched at the flimsiest straws, "listening even to Mr. F. J. Mars, engineer of the local electric light works, who urged that huge kites should be sent up carrying dynamite to be fired by electricity."

We have given much space to this interesting episode in the great Australian drought, as we hope it may prove to be the last occasion on which the rainmakers will attempt to delude the suffering people with their chemicals, their upper vacuum, their dynamite, and their false theories.

The time has not yet come when man may plow the atmosphere for rain as he plows the soil for crops. If mines must be worked and towns built in arid regions, let the promoters of these schemes be required to build aqueducts and bore wells sufficient in advance to supply the needed water, not waiting until droughts come and the people die. Every place on this globe has its rainy years and its dry years. Areas of cold and heat, wind and calm, rain and drought appear and move and disappear in irregular succession. We must prepare for them and provide against disaster. We can not control the weather, but we may control ourselves.

METEOROLOGY IN THE UNIVERSITIES.

We are pleased to learn that the higher problems of meteorology are treated in the course on "Mathematical Physics" at Cornell University. The last catalogue at page 147 has the following item:

Advanced course open to juniors, seniors, and graduates. No. 45, Mathematical theory of fluid motion, including the mechanics of the atmosphere and vortex motion. Assistant Professor James McMahon.

The Department of Geology and Geography at Harvard University offers the following courses in meteorology and climatology during the coming year.

Geology B, ^{2}hf.—Meteorology (elementary course): Lectures, written exercises, observations, and laboratory work. Half-course (second half year): Laboratory work (two hours a week). Assistant Professor R. DeC. Ward.

The lectures present the subject under the following headings: The earth's atmosphere: its composition, temperature, pressure, and general circulation. The moisture of the atmosphere: dew, frost, clouds, rainfall. Storms: cyclones, thunderstorms, tornadoes. Weather. Climate.

The laboratory work consists chiefly in the construction and study of weather maps; practice in the use of ordinary meteorological instruments; individual record of observations; weather forecasting, etc.

Geology 1, ^{1}hf.—Meteorology (second course): Lectures, observations, and reports. Half course (first half year). Assistant Professor Ward.

This course is intended to enable students to make a more thorough study of various important atmospheric phenomena than is possible in the elementary course in meteorology (Geology B). The subjects discussed are as follows: Dew: theories; measurements. Frost: conditions of formation; prediction; protection. Fog: valley, lowland, and city fogs; relation to health; utilization of fog; ocean fog and its relation to navigation. Haze. Clouds: methods of formation; classification; methods and results of cloud measurements; photography; clouds as weather prognostics. Tropical cyclones: development of the law of storms; directions for handling ships in tropical cyclones; the use of oil at sea; cyclones of West Indies, eastern seas, Indian Ocean, etc.; theory of tropical cyclones.

The laboratory work consists in the examination of charts, photographs, diagrams, etc., and in the study of text-books, reports, and articles bearing upon these illustrations. Each student will also make a series of observations on dew, frost, and clouds.

Geology 2, 2hf.—Climatology of the United States: Lectures, library work, and reports. Half course (second half year) Assistant Professor Ward.

In course 2 are considered: The controls of the climates of the United States. The annual, seasonal, and monthly distribution of temperature, pressure, winds, rainfall, cloudiness, and humidity. The probability of rainy days. The climates of special areas, as, e. g., the Plains, the Pacific coast, New England, Colorado, etc. The relations of the climates of the United States to health, habitability, occupations, and soil products. Irrigation: its present status, possible future, and dependence upon the annual rainfall or snowfall.

Geology 3, 2hf.—Climatology of the Eastern Hemisphere: Lectures, library work, and reports. Half course (second half year). Assistant Professor Ward. (Omitted in 1903–4; to be given in 1904–1905.)

Geology 19, 1hf.—General climatology: Lectures, library work, and a thesis. Half course (first half year). Assistant Professor Ward.

Course 19 is open to those only who have taken Course B, and to students in the Graduate School having equivalent preparation. It is recommended to those who intend to study medicine.

This course is designed to give a general knowledge of climatology in its broader aspects. The lectures present the subject according to the following heads: The astronomical relations of the earth and sun, the changes of the seasons, and the climatic zones and their subdivisions. Climatic factors. Controls of climate. Relations of climate and man, including the climatic control of habitability, occupation, migrations, government, etc. Physiological effects of different climates. Medical Climatology. Acclimatization. Geological, historical, and periodic changes of climate. The text-book is the English translation of Vol. I of Hann's Climatology.

The library and written work involves the special investigation by each student of some subject in connection with the course, and the preparation of a thesis.

Geology 26.—Climatology (advanced course): Conferences, reports, and theses. Assistant Professor Ward.

This course, which may be taken as a whole course or as a half course, provides more advanced work in the subjects of Courses B, 2, 3, and 19, and is open only to those who have passed in these courses. It is intended that the work done in Geology 26 should lead to results worthy of publication.

THE MOVEMENTS OF THE AIR WITHIN AREAS OF HIGH AND LOW PRESSURE.

The Deutsche Seewarte at Hamburg has published in its Archiv. Vol. XXII, the "Inaugural dissertation" of Dr. P. Polis, on the movements of the air within barometric maxima and minima, considered as a contribution to the theory of the cyclone and anticyclone. Doctor Polis's method of study consists essentially in following up certain trains of thought suggested by mathematical and other students and comparing the resulting suggestions with the actual records of wind and cloud movement at six well selected stations in Europe during each month of the year. The six stations are: Hoehenschwand, Carlsruhe, Breslau, Schneekoppe, or Riesenkoppe, Aix-la-Chapelle, or Aachen, Furnes, or Furness, on the coast of Belgium a few meters above sea level. He also studied the mean annual results for fourteen stations including the preceding six. Our general knowledge of the relation between the winds and the isobars had been expressed in fourteen short theorems by Van Bebber in his Lehrbuch, and these are revised by Doctor Polis, who expresses his own results as follows:

1. For different directions of the gradient (at sea level), the magnitude of the angular deviation of the wind from the gradient, or the angle alpha (a), is a function of the friction, but the velocity of the wind, as well as the orographic conditions, exert a modifying influence. [The gradient is normal to the isobar.—ED.]

2. In Europe, east winds or land winds have a small angular deviation, but west winds or sea winds have a large one. With gradients toward the southeast, the west and east winds even indicate inversions in the angle of deviation opposite to that required by the law of Buys-Ballot.

3. At altitudes of 1000 meters and above there is an outflow of air at the front, but an inflow of air at the rear of the barometric minima, considering the isobars as at sea level.

4. In the cyclone the angle of deviation is greater than in the anticyclone and generally increases with increasing depth of the cyclone.

5. The average annual deviation is generally greater in the warm season of the year than in the cold season.

6. The angle of deviation increases, both with approach to the coast and with increasing height above the ground.

7. In cyclonic motions of the air the swifter winds go with the greater angles of deviation; on the other hand, in anticyclonic motions the swifter winds accompany the smaller angles of deviation.

8. In cyclones over the land the most frequent value of the angle of deviation nearly coincides with the mean value, whereas at the coast and high stations the most frequent value considerably exceeds the mean of all.

9. The frequency of angles of deviation equal to or greater than 90° quickly increases with decreasing distance from the sea as well as with increasing elevation above the earth's surface.

10. At altitudes of 1600 meters the frequency curve for the angle of deviation shows two decided maxima; in one case when (a) is less than 90° in advance of cyclones, there is an inflowing current; in the second case for which (a) is greater than 90°, there is an outflowing current of air. Similar conditions prevail, even if not so distinctly accentuated in the rear of the anticyclone.

11. In land cyclones the greatest force of the winds occurs in the west quadrant; in cyclones on the coast and in the neighborhood of the coast, it occurs in the south quadrant; but in anticyclones in front.

12. The wind force is greater in winter than in summer, and greater in cyclones than in anticyclones.

13. The force of the wind decreases with increasing height of barometer and, inversely, it increases up to a certain point with decreasing height of barometer.

14. The great cyclones of the middle latitudes can not be explained by the distribution of pressure on the earth's surface alone.

15. The causes of the movement of cyclones are for the most part of a mechanical nature. The direction of their movement coincides with that of the air current having the greatest angle of deviation; the latter, as a rule, lies at an altitude of over 1000 meters.

16. On this account the direction of motion of cyclones is in general easterly for Europe, because most frequently the whole air column over an area of low pressure reaches up to a height of more than 1000 meters. Here and up to the region of the cirrus clouds the greatest outflow takes place in the east quadrant and the greatest inflow in the west quadrant.

17. If at an average altitude on the west side the angle (a) is greater than 90° (whence the wind in the west quadrant must blow out from the depression), then the movement of the depression takes place in a westerly direction.

18. In Europe the polar tendency of the cyclones in the warm season and their equatorial tendency in the cold season correspond to the greatest outflow of air on the Schneekoppe that corresponds to the direction of the line of motion of the cyclone.

19. The mean distance of the cyclonic centers from the sta-

tions here considered is greater in winter than in summer, and inversely the distances of the anticyclonic centers are smaller in winter than in summer.

20. In the land and the coast cyclones the greatest angle of deviation occurs at distances of 444-666 and 1110–1554 kilometers, respectively; the smallest angle occurs in the immediate neighborhood of the center, and in land cyclones at a distance of 1110–1332 kilometers; in coast cyclones from 1554-1776 kilometers.

21. At medium altitudes, on the contrary, the zone of 444-666 kilometers radius shows a principal minimum; thence, the angle increases as we go inward as well as outward and, at the distance of 666–888 kilometers, attains its principal maximum only to decrease again as it approaches the periphery of the cyclone.

22. In cyclones near the coast and at medium altitudes, the zones of the greatest and smallest angle (a) at a distance of from 444–666 kilometers, form the boundary of a cyclinder of air around which the outer air moves in spirals; on land, however, the orographic impediments disturb these very much.

23. In coast cyclones, in the exterior space, the greatest ascension of the air takes place on the south side, whereas the tangential forces hinder the ascent on the rear side. On the other hand, in land cyclones, in which the air flows inward spirally close up to the center, the location of the greatest ascension is transferred to the immediate neighborhood of the center. In consequence of the orographic inequalities, the maximum of rainfall may be shifted.

24. At medium altitudes in the inner zone the movements toward the center continue for the most part unchanged, but in the outer zones and in front there is an energetic outflow.

25. In regard to the individual seasons, in cyclones over the land, both at the ground and at medium altitudes, the various zones of (a's) show a shifting of location, whereas in coast cyclones the increase and decrease of the average value of the angle (a) occur in almost the same manner in the summer and winter seasons.

26. The variation, from summer to winter, of the greatest outflow on the Schneekoppe, indicated in theorem 18, and the resulting change in the direction of propagation of the cyclones, occurs also for each individual distance from the center. Since (although preponderating in the outer zone) in the winter season the greatest outflow occurs with westerly gradients and in the summer season with southwesterly gradients.

27. The velocity of the wind increases both with increasing distance from the periphery and from the center of the cyclone and attains two maxima, one of which is near the center and the other, according to the location of the cyclone, lies between 900 and 1300 kilometers distant from the center. In summer the location of the first maximum of the force of the wind is shoved away from its usual location near the center.

28. In anticyclones, both on the coast and over the land, the smallest angle (a) is close to the center; the largest angles are in the second zone and at the periphery.

29. On the other hand, at medium altitudes the largest (a) angles occur at distances of 666 to 888 kilometers and at 1998 to 2220 kilometers; the smallest angles are close to the center.

30. In anticyclones on the land and in those on the coast in winter the air flows from the center toward all sides of the periphery in spiral curves; furthermore, during the summer season, in the anticyclones on the coast a tangential movement of the air is observable in the north and east quadrants.

31. At medium altitudes the air on the front side flows rapidly outward, whereas in the rear it has a tendency to flow inward.

32. In anticyclones the velocity of the wind increases with increasing distance from the center and, according to the location of the area of high pressure, it attains two maxima, one of which lies at a distance of 666 to 888 kilometers; the other is in the neighborhood of the periphery.

33. The median altitude of the anticyclones is greater than that of the cyclones.

34. The coefficient of friction on the earth's surface (the k of Guldberg and Mohn) decreases as the stations are located nearer to the coast and, also, as the elevation above the earth's surface increases.

METEOROLOGY IN THE SUMMER SCHOOLS.

The development of summer schools at various universities has become a very important factor in our educational scheme. There are probably a dozen large institutions, such as Harvard, Cornell, Chicago, Columbian at Washington, and the University of Virginia at Charlottesville, that have taken up this work with great enthusiasm and very important results. These summer schools are not rivals of the various Chatauquan Assemblies, nor of the normal schools in the national educational assemblies. They fill a different field; they are peculiarly adapted to be the means of introducing new ideas to the teachers and officers of normal schools. They bring the best teachers of graded schools and academies and smaller colleges where teaching is the main thought, into close contact with the most progressive spirit of education, that which seeks out new lines of thought and new ways of looking at familiar subjects, thus leading up to original thought and research on the part of the scholar. It must be acknowledged that the rapid progress of modern civilization, or man's conquest of nature has depended on the development of the habits of independent original, but logical, not erratic, research into the laws of nature. There are those who in such work wander off into attractive but delusive byways and fail to accomplish anything. Such were the "Paradoxers" of De Morgan. It is the province of modern education culminating in the modern university, to stimulate logical and sound, original and independent trains of thought and work. From this point of view the summer school is doing a fine work, and Weather Bureau men who are so situated as to be able to contribute six weeks of hard work to this educational campaign will doubtless be rewarded by finding their best ideas reappear in the normal schools and the graded schools of the country.

THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart IV and the average values and departures from normal are shown in Tables I and VI.

The mean barometric pressure was highest over the immediate coast of the North Pacific States, with readings of 30.10 inches. Another, and extensive, area of high but slightly lower mean pressure overlay the Ohio Valley and Tennessee and the east Gulf and South Atlantic States. The mean pressure was lowest over southwestern Arizona, with a minimum reading of 29.75 inches at Yuma.

The pressure was above the normal in the Pacific States, western Nevada, the northern Plateau region, in the Gulf States, and the Ohio Valley generally, and Tennessee, and in parts of the Mississippi Valley, with the greatest departures on the northern coast of California; elsewhere the mean pressure was below the normal, with the maximum minus departures at northern New England stations, where they were about —. 10 inch.

The mean pressure for July, 1903, increased over June, 1903, in the Gulf and South Atlantic States, the southern portions of the Middle Atlantic States, the western part of the lower Lake region, the southern part of the upper Lake region, the Ohio Valley and Tennessee, the central Mississippi Valley, the Pacific States, and the western portions of the Plateau regions; elsewhere the mean pressure decreased from that of June, 1903. In the southeastern quarter of the country the increase was quite marked. The decrease in pressure was greatest from the northwestern portions of Texas and the Indian Territory northwestward over eastern Montana and northeastward over Lake Superior.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart VI.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	67.4	− 0.7	+ 8.8	+ 1.3
Middle Atlantic	12	74.8	+ 0.2	+10.2	+ 1.5
South Atlantic	10	79.6	+ 0.5	+ 3.0	+ 0.4
Florida Peninsula*	8	81.5	+ 0.1	+ 4.5	+ 0.6
East Gulf	9	80.4	− 0.4	− 8.2	− 1.2
West Gulf	7	80.5	− 1.4	−10.5	− 1.5
Ohio Valley and Tennessee	11	77.2	+ 0.3	+ 2.7	+ 0.4
Lower Lake	8	70.7	− 0.5	+10.3	+ 1.5
Upper Lake	10	67.5	− 0.2	+13.9	+ 2.0
North Dakota*	8	67.0	− 1.9	+ 4.5	+ 0.6
Upper Mississippi Valley	11	74.8	− 0.4	+ 6.7	+ 1.0
Missouri Valley	11	74.8	− 0.4	+ 3.1	+ 0.4
Northern Slope	7	67.8	− 1.6	− 0.8	− 0.1
Middle Slope	6	77.5	+ 1.2	− 5.8	− 0.8
Southern Slope*	6	81.8	+ 1.9	−10.6	− 1.5
Southern Plateau*	13	76.7	− 1.9	−12.0	− 1.7
Middle Plateau*	8	68.4	− 3.0	−20.2	− 2.9
Northern Plateau*	12	65.5	− 2.6	+ 2.1	+ 0.3
North Pacific	7	59.3	− 2.0	− 2.9	− 0.4
Middle Pacific	5	62.0	− 2.5	− 7.3	− 1.0
South Pacific	4	68.2	− 2.4	− 4.9	− 0.7

*Regular Weather Bureau and selected voluntary stations.

The temperature was above the normal in southern New England, the southeastern portions of New York and Pennsylvania, New Jersey, from the Atlantic coast of Virginia, North Carolina, and northern South Carolina westward to central Colorado and western New Mexico, in the upper Rio Grande Valley, about southern Lake Michigan, in eastern upper Michigan, and lower Michigan, except the south-central part, but nowhere did the departure equal an average of + 3° per day; elsewhere the mean temperature was below the normal, with decided departures, ranging from an average of 2° to 5.9° per day in Idaho, Nevada, Washington, Oregon, northern and central California, southwestern Montana, and the western portions of the Dakotas; and 2.5° to 3.5° in portions of southeastern Texas. By geographical districts the temperature was above the normal in the Middle and South Atlantic States, Florida Peninsula, Ohio Valley and Tennessee, and the middle and southern slope regions, and below the normal in the remaining districts.

The isotherms of 70° and 80° of mean temperature were located somewhat to the southward of their positions in July, 1902, and mean temperatures of less than 80° were reported from portions of the interior of southeastern Texas, and southwestern Arkansas.

The area embraced by the isotherms of 100° and 110° of maximum temperature is much less than it was in July, 1902, and the isotherms lay to the southward. The isotherms of minimum temperature also lay to the southward of the positions they occupied in July, 1902, and this is markedly so with reference to the isotherm of 70°, and also of 60°, except in portions of the central Mississippi Valley. Freezing temperature was reported from northwestern Wisconsin.

In Canada.—Prof. R. F. Stupart says:

The temperature was below the average throughout Canada, except at a few isolated places in the Peninsula of Ontario where the average was either maintained or slightly exceeded. The negative departure was as much as 4° in portions of southern Alberta and southern Assiniboia, and 3° in many parts of British Columbia, but elsewhere from 1° to 2° was the usual departure from the average.

PRECIPITATION.

The precipitation was above the normal in central and eastern Texas, central and southwestern Arkansas, southern Louisiana, western and west-central Florida, southern New Jersey, extreme northern Maryland, District of Columbia, western Pennsylvania, extreme western New York, northern Ohio, Michigan, except the extreme western and south-central portions, Wisconsin, northern Illinois, Iowa, southern Minnesota, southern and western South Dakota, western North Dakota, central Nebraska, north-central Kansas, Montana, northern Idaho, Washington, except on the immediate Pacific coast, and in portions of western Colorado, northern Arizona, and southern Illinois; elsewhere it was below the normal. In southeastern Texas the excess of precipitation was nearly 11.0 inches, and nearly 7.0 inches in southeastern New Jersey.

By geographic districts the precipitation was normal in the middle and south Pacific districts, slightly above in the Middle Atlantic States, upper Mississippi Valley and northern slope, and considerably above in the Lake region and west Gulf States; elsewhere it was below the normal, and except in the Ohio Valley and Tennessee, and the middle and southern slope districts the departures were slight. Rainfall ranging from 10.0 inches to 16.4 inches occurred in portions of southeastern Texas, south-central Louisiana, southwestern Florida, and southern New Jersey. Practically no rainfall occurred in California and Nevada.

The distribution of total monthly precipitation is shown on Chart III.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	2.91	81	−0.7	+0.9
Middle Atlantic	12	4.58	107	+0.3	+0.3
South Atlantic	10	3.62	61	−2.3	−0.2
Florida Peninsula*	8	5.73	88	−0.8	+5.4
East Gulf	9	5.09	91	−0.5	+0.6
West Gulf	7	6.92	229	+3.9	+2.9
Ohio Valley and Tennessee	11	2.65	64	−1.5	−2.3
Lower Lake	8	4.08	132	+1.0	+1.7
Upper Lake	10	4.97	152	+1.7	−0.7
North Dakota*	8	1.90	76	−0.6	−3.6
Upper Mississippi Valley	11	4.15	111	+0.4	−1.5
Missouri Valley	11	3.54	94	−0.2	+0.2
Northern Slope	7	2.45	148	+0.8	0.0
Middle Slope	6	1.88	65	−1.0	+0.4
Southern Slope*	6	1.51	59	−1.5	−2.0
Southern Plateau*	13	0.94	70	−0.4	+0.3
Middle Plateau*	8	0.53	84	−0.1	0.0
Northern Plateau*	12	0.89	75	−0.3	−3.6
North Pacific	7	0.86	90	−0.1	−6.7
Middle Pacific	5	0.01	100	0.0	−3.7
South Pacific	4	0.00	100	0.0	+0.4

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The rainfall generally was above the average, and in many localities to a marked extent, but in certain small sections of the Dominion the fall was at the same time deficient. The sections, with the negative departure, were noticeably the western portion of the Province of Quebec, Prince Edward Island, and Cape Breton as well as a few scattered

points in Ontario, the Northwest Territories and on the coast line of British Columbia. Over the mainland of British Columbia the rainfall was much above the average, and between the 4th and 6th there was a snowfall of about 2 feet on the mountain ranges, extending to quite a low altitude for the season of the year. Southern Alberta was remarkable for its large rainfall, so also was the Qu'Appelle Valley, but the largest positive departures were in the Peninsula of Ontario, mainly no doubt attributable to heavy local thunderstorms. Port Dover was 5.9 inches above the average; Port Stanley, 4.1 inches above; Owen Sound, 3.3 inches above, and Toronto, 1.4 inches above. The positive departure was also marked in the Peninsula of Quebec, likewise in northern New Brunswick, and over the Island of Anticosti.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 26. Arizona, 8, 16, 22, 24. Colorado, 2, 3, 7, 9, 10, 13, 14, 16, 17, 18, 19, 20, 22, 24, 26, 27, 29, 31. Connecticut, 1, 14, 15, 20, 21, 26. Delaware, 22. Florida, 23, 24. Georgia, 7, 25. Idaho, 1, 6, 11, 16, 18, 22, 23. Illinois, 1, 11, 17, 21, 28, 29. Indiana, 2, 21, 22. Iowa, 8, 17, 20, 21, 26, 28, 29. Kansas, 1, 2, 3, 10, 11, 13, 15, 16, 29, 31. Kentucky, 11, 22. Louisiana, 12. Maine, 8, 15. Maryland, 3, 12, 20, 22, 29, 30. Massachusetts, 14. Michigan, 1, 2, 3, 11, 14, 17, 18, 19, 21, 28. Minnesota, 16, 27. Mississippi, 31. Missouri, 1, 20, 21, 23, 30. Montana, 1, 3, 6, 7, 13, 17, 19, 23, 24, 25, 26, 27. Nebraska, 3, 10, 11, 12, 13, 15, 20, 21, 23, 28, 29, 31. New Jersey, 2, 14, 20, 22, 29. New Mexico, 19, 28. New York, 14, 15, 20, 21, 29. North Carolina, 5, 23, 28. North Dakota, 9, 10. Ohio, 2, 14, 21. Oklahoma, 4. Oregon, 1, 2, 20, 23. Pennsylvania, 3, 4, 5, 11, 14, 15, 20, 22, 30. South Carolina, 22. South Dakota, 1, 2, 8, 9, 10, 11, 15, 20, 21, 25, 27, 28. Tennessee, 8, 9, 18, 19, 22, 28, 29. Texas, 11, 24. Utah, 6, 16, 24. Vermont, 15, 16. Virginia, 20. Washington, 1, 6, 8, 9, 22, 23. West Virginia, 3. Wisconsin, 1, 9, 28. Wyoming, 1, 2, 3, 17, 18, 24, 29, 30, 31.

SLEET.

The following are the dates on which sleet fell in the respective States:

Colorado, 3. Wyoming, 3.

HUMIDITY.

The relative humidity was normal in the middle slope district and Missouri Valley; below in the Atlantic States, Florida Peninsula, east Gulf States, and the southern slope, southern Plateau, and middle Pacific districts, and above normal in the remaining districts.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	78	— 2	Missouri Valley	66	0
Middle Atlantic	73	— 1	Northern Slope	61	+ 9
South Atlantic	76	— 4	Middle Slope	60	0
Florida Peninsula	79	— 1	Southern Slope	58	— 1
East Gulf	77	— 1	Southern Plateau	33	— 5
West Gulf	78	+ 4	Middle Plateau	34	+ 2
Ohio Valley and Tennessee	70	+ 1	Northern Plateau	49	+ 8
Lower Lake	72	+ 3	North Pacific	77	+ 2
Upper Lake	74	+ 2	Middle Pacific	65	— 1
North Dakota	67	+ 1	South Pacific	67	+ 3
Upper Mississippi Valley	69	+ 1			

SUNSHINE AND CLOUDINESS.

The cloudiness was in excess in New England, the Gulf States, Lake region, Missouri Valley, North Dakota, northern slope district, and the northern and middle Plateau, and Pacific regions; elsewhere it was below the average.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.3	+ 0.4	Missouri Valley	4.5	+ 0.1
Middle Atlantic	4.2	— 0.6	Northern Slope	4.3	+ 0.5
South Atlantic	3.8	— 1.2	Middle Slope	3.7	— 0.3
Florida Peninsula	4.9	— 0.1	Southern Slope	3.7	— 0.1
East Gulf	5.2	+ 0.2	Southern Plateau	2.4	— 0.9
West Gulf	4.3	+ 0.1	Middle Plateau	2.2	+ 0.2
Ohio Valley and Tennessee	4.4	— 0.2	Northern Plateau	3.4	+ 0.3
Lower Lake	4.6	+ 0.1	North Pacific	5.6	+ 1.2
Upper Lake	5.0	+ 0.3	Middle Pacific	3.2	+ 0.3
North Dakota	4.4	+ 0.1	South Pacific	1.9	+ 0.8
Upper Mississippi Valley	4.1	— 0.2			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	17	60	nw.	New York, N. Y	2	72	nw.
Chicago, Ill	4	70	s.	Do	11	54	nw.
Do	17	56	se.	Point Reyes Light, Cal	1	74	nw.
Grand Rapids, Mich	4	56	sw.	Do	2	58	nw.
Green Bay, Wis	1	59	nw.	Do	4	57	nw.
Milwaukee, Wis	17	50	e.	Do	5	80	nw.
Minneapolis, Minn	2	58	ne.	Do	6	74	nw.
Do	9	60	nw.	Do	12	52	nw.
Modena, Utah	5	55	sw.	Do	13	52	nw.
Do	6	65	sw.	Do	18	53	nw.
Mount Tamalpais, Cal	1	60	nw.	Do	19	50	nw.
Do	3	57	n.	Southeast Farallon, Cal	1	55	nw.
Do	4	60	nw.	Do	2	50	nw.
Do	5	71	nw.	Tatoosh Island, Wash	1	52	s.
Do	6	62	nw.	Toledo, Ohio	1	63	w.
Do	20	50	nw.	Williston, N. Dak	7	50	w.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 8139 thunderstorms were received during the current month as against 8266 in 1902 and 6045 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 29th, 537; 11th, 468; 30th, 411; 10th and 22d, 383.

Reports were most numerous from: Missouri, 451; Nebraska, 439; New York, 393; Iowa, 358.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 5th to 13th.

In Canada: Thunderstorms were reported at St. John, N. B., 10, 12, 17, 24, 26. Sidney, 2, 18. Grand Manan, 2, 23. Yarmouth, 10, 30. Charlottetown, 11, 12, 15, 18, 24, 26. Chatham, 16. Father Point, 7, 12. Quebec, 1, 8, 10, 11, 13, 14, 15, 16, 30. Montreal, 1, 7. Ottawa, 20, 21, 23. Kingston, 2,

21, 22, 23. Toronto, 3, 9, 11, 19. White River, 5, 18, 20. Port Stanley, 2, 3, 5, 11, 14, 19, 20, 21, 22, 29, 30. Saugeen, 3, 29. Parry Sound, 5, 15, 19, 20, 30. Port Arthur, 1, 19. Winnipeg, 9, 10, 15, 24, 27, 28, 29. Minnedosa, 5, 6, 20, 27. Qu'Appelle, 1, 7, 14, 15, 26, 27. Medicine Hat, 6, 7, 19, 24, 26, 29. Swift Current, 10, 14, 19, 20, 26, 27. Calgary, 26, 30. Banff, 12, 18, 22, 23, 26. Prince Albert, 22, 24. Battleford, 11, 23, 29, 30. Kamloops, 11, 23, 29, 30. Barkerville, 13. New Westminster, 13. Dawson, 16. Hamilton, Bermuda, 25.

An aurora was reported from Quebec on the 27th.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, Forecast Official, in charge of Division of Meteorological Records.

For description of tables and charts see page 286 of REVIEW for June, 1903.

TABLE 1.—*Climatological data for Weather Bureau stations, July, 1903.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.			Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							67.4	— 0.7								73	78	2.91	— 0.7									5.3	
Eastport	76	69	82	29.75	29.83	— .10	59.4	— 1.0	84	2	67	45	27	52	37	56	54	88	3.85	0.0	14	6,087	s.	44	ne.	19	5	13	13	6.9	
Portland, Me.	108	81	117	29.74	29.85	— .10	66.6	— 1.9	90	2	75	51	27	58	33	61	57	76	2.50	— 1.1	12	6,206	s.	38	nw.	27	6	14	11	6.0	
Concord	298	70	79	29.55	29.86	— .10	68.0	— 1.9	95	9	78	49	28	58	34	.....	.....	.....	6.00	+ 2.1	13	3,769	ne.	24	w.	2	7	17	7	5.9	
Northfield	876	16	60	28.96	29.89	— .05	64.0	— 1.1	89	9	74	41	28	54	34	60	57	75	2.71	— 1.0	17	5,551	s.	44	nw.	2	4	9	18	7.1	
Boston	125	115	181	29.75	29.88	— .08	71.4	+ 0.1	93	10	80	55	16	63	26	64	59	69	2.99	— 0.4	12	7,547	w.	36	ne.	19	10	12	9	5.2	
Nantucket	12	43	85	29.89	29.90	— .08	67.6	+ 0.4	87	9	74	56	5	62	25	63	61	83	1.81	— 0.6	6	9,020	sw.	48	se.	19	6	20	5	4.9	
Block Island	26	11	60	29.89	29.92	— .05	68.4	0.0	86	9	75	55	28	62	20	63	61	80	1.90	— 1.3	10	10,048	sw.	42	se.	18	15	13	3	3.6	
Narragansett	.....	10	38	.....	.....	.....	69.3	— 0.9	94	8	78	49	28	60	30	.....	.....	.....	2.29	— 0.9	10	.....	sw.	.....	.....	.....	20	5	6	.....	
New Haven	106	117	140	29.80	29.91	— .06	72.0	+ 0.2	94	10	81	52	28	63	26	65	61	73	2.17	— 2.8	10	5,774	sw.	37	n.	26	20	9	2	3.1	
Mid. Atlantic States.							74.8	+ 0.2										73	4.56	+ 0.3									4.2	
Albany	97	102	115	29.81	29.91	— .05	71.4	— 1.0	95	9	81	49	28	62	32	65	62	75	3.51	— 0.4	14	4,755	s.	26	se.	22	8	13	10	5.7	
Binghamton	875	79	90	29.02	29.93	— .04	67.8	— 0.9	92	9	78	41	28	57	39	.....	.....	.....	2.67	— 0.6	14	3,720	w.	24	w.	15	8	14	9	5.5	
New York	314	108	350	29.60	29.93	— .05	74.3	+ 0.8	94	9	82	57	16	66	23	66	63	73	3.23	— 1.0	14	8,547	nw.	72	nw.	2	9	18	4	5.1	
Harrisburg	374	94	104	29.56	29.95	— .03	74.0	+ 1.1	94	9	83	53	28	65	29	66	62	70	1.76	— 2.5	9	4,389	w.	40	w.	3	7	16	8	5.4	
Philadelphia	117	168	184	29.82	29.94	— .04	76.4	+ 0.7	96	10	85	57	28	68	24	67	62	66	3.84	— 0.3	14	7,015	w.	44	s.	18	15	9	7	4.2	
Scranton	805	111	119	29.10	29.95	— .03	70.0	.....	92	9	81	44	28	59	40	63	60	72	4.89	.....	16	4,804	sw.	30	nw.	3	8	13	10	5.3	
Atlantic City	52	39	48	29.90	29.95	— .03	72.8	+ 0.9	93	26	79	55	28	66	23	68	66	82	10.14	+ 6.7	12	5,789	sw.	34	s.	18	12	15	4	4.0	
Cape May	17	47	51	29.96	29.97	— .01	73.3	— 0.3	91	9	79	55	28	67	19	68	.....	.....	6.49	+ 3.2	15	4,929	w.	32	sw.	18	18	10	3	3.2	
Baltimore	123	69	117	29.82	29.94	— .04	77.2	0.0	96	10	86	59	15	68	26	68	64	67	7.65	+ 3.0	13	5,007	w.	46	w.	12	13	12	6	4.3	
Washington	112	59	76	29.84	29.96	— .04	76.0	— 0.8	96	2	86	56	17	66	27	69	66	74	5.17	+ 0.6	9	3,858	nw.	28	sw.	12	19	9	3	3.4	
Cape Henry	18	11	58	29.95	29.97	— .02	78.0	+ 1.0	96	10	86	65	28	70	23	.....	.....	.....	3.76	— 1.9	9	8,531	sw.	44	n.	13	19	8	4	3.2	
Lynchburg	681	83	88	29.26	29.98	— .03	77.6	+ 0.1	96	4	88	54	16	67	28	69	65	70	2.80	— 1.1	8	2,443	sw.	21	nw.	4	15	14	2	3.6	
Norfolk	91	102	111	29.89	29.98	— .02	78.7	+ 0.2	96	3	87	64	13	70	26	72	69	76	4.00	— 1.9	8	6,156	sw.	30	sw.	30	21	7	3	3.4	
Richmond	144	82	90	29.84	29.98	— .03	79.3	.....	97	3	89	62	15	70	25	.....	.....	.....	5.17	.....	8	3,902	sw.	30	sw.	12	14	12	5	4.3	
Wytheville	2,293	40	47	27.69	30.04	+ .03	71.5	.....	90	10	83	46	16	60	32	65	62	79	2.61	.....	11	3,035	w.	24	w.	18	15	15	1	2.8	
S. Atlantic States.							79.6	+ 0.5								76	78	3.62	— 2.3									3.8	
Asheville	2,255	53	75	27.75	30.04	+ .02	72.6	+ 0.6	90	18	84	51	15	62	30	66	63	81	5.59	+ 0.8	11	2,991	nw.	31	se.	28	9	20	2	4.5	
Charlotte	773	68	76	29.19	30.00	— .02	79.7	+ 1.5	96	27	90	61	16	70	26	70	66	70	1.89	— 3.6	6	4,639	sw.	25	sw.	30	13	15	3	3.9	
Hatteras	11	12	47	30.00	30.01	.00	79.6	+ 1.7	89	30	85	67	14	75	17	74	72	81	1.94	— 4.5	4	10,376	sw.	48	n.	13	20	9	2	2.9	
Kittyhawk	8	12	30	.....	.....	.....	79.2	+ 1.2	93	*	85	66	*	73	20	.....	.....	.....	5.72	— 0.1	5	9,506	sw.	.....	.....	.....	27	2	2	1.7	
Raleigh	376	93	101	29.60	29.98	— .04	79.4	+ 2.3	96	4	90	60	16	69	29	71	67	71	4.41	— 0.6	9	4,526	sw.	32	se.	27	19	9	3	3.3	
Wilmington	78	82	90	29.92	29.99	— .02	80.0	+ 0.3	96	27	88	66	16	72	24	73	70	79	3.00	— 4.2	6	5,928	sw.	31	sw.	13	11	20	0	3.9	
Charleston	48	14	92	29.99	30.03	.00	81.1	— 0.7	95	19	87	70	14	75	20	74	72	78	3.23	— 4.4	9	6,946	sw.	36	ne.	5	8	20	3	4.5	
Columbia, S. C.	351	114	122	29.65	30.01	— .01	80.8	+ 0.2	98	27	90	64	15	71	25	71	68	72	2.94	— 2.7	11	5,125	sw.	36	sw.	12	14	13	4	4.1	
Augusta	180	89	97	29.82	30.00	— .02	81.0	— 0.1	97	27	90	65	15	72	26	72	69	72	2.02	— 3.2	11	4,103	se.	36	sw.	12	16	11	4	3.5	
Savannah	65	79	89	29.96	30.03	.00	80.8	— 1.1	96	23	88	70	16	73	22	73	71	79	6.54	+ 0.7	9	5,069	sw.	27	e.	22	13	12	6	4.8	
Jacksonville	43	101	129	29.97	30.01	— .02	81.2	— 0.9	97	23	89	69	16	73	21	74	72	80	2.54	— 3.9	11	6,114	s.	33	s.	13	11	14	6	4.6	
Florida Peninsula.							81.9	— 0.2								79	79	5.13	— 0.6									4.9	
Jupiter	28	10	48	30.01	30.03	.00	80.8	0.0	91	17	87	71	29	75	17	76	74	80	3.23	— 2.0	15	6,293	e.	40	se.	24	5	24	2	5.1	
Key West	22	10	53	29.99	30.00	— .03	83.8	— 0.1	91	20	89	74	25	79	14	76	74	75	2.87	— 1.0	14	6,032	se.	35	w.	15	12	18	1	4.4	
Sand Key	24	.....	.....	.....	.....	.....	82.3	.....	92	20	86	72	25	79	13	.....	.....	.....	1.41	.....	11	8,979	e.	40	s.	31	6	21	4	5.2	
Tampa	34	60	67	29.99	30.02	— .02	81.0	— 0.4	94	8	90	67	24	72	24	74	72	82	9.34	+ 1.2	17	3,905	e.	28	se.	1	9	17	5	4.8	
East Gulf States.							80.4	— 0.4								77	77	5.09	— 0.5									5.2	
Atlanta	1,174	190	216	28.82	30.04	+ .02	78.4	0.0	93	27	87	64	15	70	22	70	68	76	4.29	— 0.6	10	6,658	nw.	45	n.	21	5	21	5	5.7	
Macon	370	93	99	29.64	30.03	+ .01	80.3	.....	96	23	90	63	15	71	25	.....	.....	.....	4.45	.....	10	3,441	sw.	30	sw.	28	11	12	8	4.9	
Pensacola	56	79	96	29.97	30.03	+ .02	81.0	+ 0.2	93	22	87	70	15	75	21	.....	.....	.....	8.07	+ 1.3	10	6,007	w.	33	ne.	7	12	11	8	4.9	
Mobile	57	88	96	29.97	30.02	+ .01	80.8	— 0.4	96	23	88	66	15	74	24	73	71	76	5.03	— 1.5	14	4,464	sw.	30	nw.	13	12	11	8	4.7	
Montgomery	223	100	112	29.78	30.00	— .02	80.6	— 0.9	96	22	90	65	14	72	24	72	70	75	2.25	— 2.3	14	3,881	sw.	30	s.	27	7	16	8	5.9	
Meridian	375	84	93	29.63	30.02	.00	79.7	— 0.3	97	22	90	61	15	70	29	.....	.....	.....	6.68	+ 1.2	16	2,924	sw.	25	w.	30	10	19	2	4.3	
Vicksburg	247	62	74	29.72	29.97	— .03	80.6	— 0.7	94	22	89	64	14	72	25	72	70	79	2.11	— 2.4	10	4,021	se.	40	w.	30	11	6	14	5.4	
New Orleans	51	88	121	29.96	30.02	+ .02	81.8	— 0.4	95	23	89	69	4	74	19	74	72	78	7.17	+ 0.7	14	4,728	se.	24	se.	25	8	9	14	6.2	
West Gulf States.							80.5	— 1.4								78	78	6.92	+ 3.9									4.3	
Shreveport	249	77	84	29.74	30.00	+ .02	81.2	— 1.3	97	8	91	67	14	72	25	73	70	77	3.32	— 0.2	16	4,234	se.	34	nw.	12	9	13	9	5.0	
Fort Smith	457	79	94	29.49	29.96	— .01	80.2	+ 0.2	95	22	90	66	4	71	28	72	68	71	2.00	— 2.4	5	5,163	e.	33	nw.	4	5	24	2	4.7	
Little Rock	357	93	100	29.63	30.00	+ .01	80.0	— 0.3	94	10	88	67	14	72	24	72	70	77	6.18	+ 2.2	10	4,613	s.	40	se.	11	12	14	5	4.2	
Corpus Christi	20	48	53	29.94	29.97	+ .01	81.4	— 0.3	90	13	87	68	28	76	17	76	74	82	6.87	+ 5.6	7	7,520	se.	33	e.	25	18	10	3	3.5	
Fort Worth	670	106	114	29.28	29.98	+ .02	80.6	.....	98	24	89	67	26	72	28	.....	.....	.....	1.84	.....	4	7,567	s.	30	s.	4	21	6	4	3.2	
Galveston	54	106	112	29.92	29.97	— .01	81.4	— 2.5	91	20	86	67	26	77	16	76	73	78	13.79	+10.7	10	7,248	se.	33	ne.	5	14	15	2	3.5	
Palestine	510	73	79	29.47	29.98	+ .01	79.6	— 1.9	93	23	88	67	*	71	26	73	71	81	8.76	+ 6.2	15	4,556	s.	36	sw.	29	9	12	10	5.3	
San Antonio	701	80	91	29.23	29.95	.00	79.8	— 3.5	96	20	89	65	5	71	25	73	70	77	7.52	+ 5.3	10	4,319	se.	34	ne.	25	10	12	9	5.0	
Taylor	583	55	63	29.36	29.97	+ .01	79.8	.....	96	19	89	65	23	71	26	.....	.....	.....	14.37	.....	12	5,173	s.	33	se.	2	12	13	6	4.5	
Ohio Val. and Tenn.							77.2	+ 0.3								70	70	2.65	— 1.5									4.4	
Chattanooga	762	106	112	29.24	30.04	+ .02	78.0	+ 0.2	92	28	88	59	15	68	25	70	67	75	2.03	— 2.2	15	4,159	sw.	30	sw.	3	5	22	4	5.5	
Knoxville	1,004	35	88	28.99	30.02	.00	77.3	+ 0.9	95	28	88	56	15	67	27	69	66	74	2.26	— 2.1	10	4,600	sw.	31	sw.	22	13	15	3	4.1	
Memphis	397	140	154	29.60	30.02	+ .02	80.8	+ 0.1	94	7	89	67	11	73	22	74	72	79	1.09	— 2.4	9	5,827	sw.	44	w.	29	16	13	2	4.0	
Nashville	546	122	134	29.43	30.02	+ .01	79.6	+ 0.3	94	18	89	61	14	70	25	71	68	72	3.04	— 1.3	14	3,984	nw.	42	nw.	18	11	16	4	4.4	
Lexington	989	75	102	28.96	30.01	.00	76.6	+ 1.2	94	28	86	58	14	68	25	.....	.....	.....	2.62	— 2.5	11	6,749	sw.	40	e.	22	14	12	5	3.9	
Louisville	525	114	136	29.44	30.02	+ .02	79.2	+ 0.8	98	3	89	60	14	69	28	68	64	63	1.25	— 2.5	6	5,365	sw.	34	sw.	29	15	11	5	4.2	
Evansville	431	72	82	29.52	29.99	— .01	79.4	.....	96	10	88	61	16	70	27	.....	.....	.....	2.28	.....	9	4,553	s.	27	ne.	16	12	16	3	4.3	
Indianapolis	822	154	164	29.13	30.00	+ .01	76.0	— 0.2	94	10	86	57	14	66	26	66	61	63	2.54	— 1.7	7	6,812	nw.	46	sw.	18	9	16	6	4.9	
Cincinnati	628	152	160	29.34	30.00	.00	77.8	+ 0.4	96	10	87	59	14	68	27	67	61	60	2.31	— 1.1	7	4,813	sw.	29	w.	18	9	19	3	4.5	
Columbus	824	173	190	29.13	29.99	— .01	74.5	— 0.4	94	9	85	52	15	64	27	65	59	63	2.05	— 1.2	7	7,605	sw.	45	sw.	29	10	17	4	4.5	
Pittsburg	842	116	123	29.09	29.97	— .03	74.3	— 0.7	92	9	83	54	16	65	27	66	62	70	5.66	+ 0.9	14	3,731	nw.	25	w.	22	10	18	3	4.6	
Parkersburg	638	77	84	29.33	30.01	.00	75.1	+ 0.3	94	4	86	49	16	65	29	67	64	71	4.25	— 0.4	9	3,513	sw.	36	nw.	21	21	8	2	2.9	
Elkins	1,940	41	50	28.01	30.01	.00	69.0	.....	90	5	82	44	16	56	38	63	61	81	3.60	.....	13	2,449	n.	23	nw.	29	7	18	6	5.5	
Lower Lake Region.							70.7	— 0.5								72	72	4.08	+ 1.0									4.6	
Buffalo	767	178	206	29.12	29.93	— .04	68.8	— 0.9	84	9	75	49	15	63	22	63	60	74	4.07	+ 0.9	17	9,221	w.	41	w.	1	4	20	7	6.2	
Oswego	335	76	91	29.55	29.91	— .05	67.0	— 2.0	86	1	74	50	28	60	23	62	59	76	2.61	— 0.5	15	6,306	w.	26	nw.	29	13	16	2	4.5	
Rochester	523	81	102	29.38	29.93	— .04	70.0	— 0.4	92	9	79	50	15	61	28	63	59	73	2.55	— 0.4	13	5,923	sw.	31	w.	30	9	16	6	5.0	
Syracuse	597	97	113	29.29	29.92	— .05	67.8	.....	89	9	76	48	28	60	27	.....	.....	.....	3.63	.....	15	7,666	w.	35	nw.	22	8	18	5	5.5	
Erie	713	92	102	29.20	29.96	— .02	70.2	— 0.8	88	1	77	53	14	64	26	65	61	73	3.57	+ 0.8	14	6,473	w.	33	s.	18	15	12	4	4.6	
Cleveland	762	190	201	29.17	29.98	— .01	71.2	— 0.3	89	1	78	56	28	64	30	64	61	71	5.23	+ 1.7	15	8,759	w.	48	w.	1	9	19	3	4.5	
Sandusky	629	62	70	29.30	29.97	— .02	73.0	— 0.1	94	4	81	54	16	65	26	.....	.....	.....	4.45	+ 1.3	11	5,467	nw.	35	nw.	13	20	10	1	3.0	
Toledo	628	120	127	29.31	29.98	— .01	73.0	— 0.4	94	4	82	51	15	64	26	64	60	68	5.54	+ 2.6	12	6,127	sw.	63	w.	1	17	13	1	3.7	
Detroit	730	153	193	29.18	29.96	— .02	72.6	+ 1.0	92	8	82	50	15	64	26	65	61	71	4.59	+ 1.2	12	7,058	w.	40	se.	18	9	20	2	4.3	
Upper Lake Region.							67.5	— 0.2								74	74	4.97	+ 1.7									5.0	
Alpena	609	63	80	29.29	29.96	— .01	66.0	+ 0.7	93	8	75	46	15	57	28	60	57	75	5.06	+ 2.1	12	6,670	nw.	35	se.	28	10	11	10	5.3	
Escanaba	612	40	48	29.29	29.94	— .03	64.9	— 1.8	85	8	74	45	31	56	26	61	58	78	7.85	+ 4.6	13	4,979	s.	24	nw.	21	12	9	10	4.9	
Grand Rapids	707	127	165	29.23	29.98	.00	71.0	— 2.3	93	4	81	49	15	61	28	64	60	72	4.14	— 0.1	10	6,540	nw.	56	sw.	4	15	14	2	3.9	
Houghton	668	66	74	29.20	29.91	— .05	64.0	.....	94	7	74	47	15	54	35	.....	.....	.....	4.66	.....	13	5,083	w.	29	s.	9	16	10	5	3.8	
Marquette	734	79	116	29.15	29.94	— .02	63.8	— 1.1	94	7	72	48	14	56	32	58	54	70	6.79	+ 3.8	15	6,822	nw.	42	sw.	7	9	12	10	5.7	
Port Huron	638	70	120	29.30	29.98	.00	69.4	+ 0.9	90	8	79	46	15	60	29	63	60	74	4.89	+ 2.5	12	6,763	ne.	36	w.	1	7	15	9	5.3	
Sault Ste. Marie	614	40	61	29.26	29.92	— .05	62.8	+ 1.0	87	8	71	48	16	55	30	57	54	75	4.66	+ 1.7	13	5,670	w.	33	nw.	30	14	5	12	5.0	
Chicago	823	241	274	29.12	30.00	+ .02	72.2	+ 0.2	92	1	78	59	13	66	21	64	60	70	4.78	+ 1.3	11	10,425	ne.	70	s.	4	12	16	3	4.5	
Milwaukee	681	124	142	29.25	29.98	+ .01	71.0	+ 1.8	91	28	79	56	15	63	24	65	63	81	4.83	+ 1.4	10	6,710	w.	50	e.	17	16	8	7	4.2	
Green Bay	617	49	86	29.29	29.95	— .02	69.7	— 0.3	89	28	80	48	31	60	26	62	59	72	3.54	+ 0.2	11	6,665	sw.	59	nw.	1	4	13	14	6.6	
Duluth	702	95	116	29.18	29.94	— .01	64.3	— 1.6	92	7	73	46	4	56	27	58	54	71	3.50	— 0.2	15	6,500	ne.	35	w.	7	7	18	6	5.4	

TABLE I.—*Climatological data for Weather Bureau stations, July, 1903*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
North Dakota.							66.5	— 2.1									67	2.49	— 0.3									4.4	
Moorhead	935	54	60	28.94	29.94	.00	67.0	— 0.6	92	7	78	44	31	56	30	60	56	71	2.86	— 1.0	10	6,612	se.	35	e.	2	13	11	7	4.4	
Bismarck	1,674	16	29	28.18	29.93	.00	67.8	— 1.7	99	24	80	40	30	55	40	59	53	61	2.18	— 0.2	6	7,559	nw.	38	nw.	7	20	8	3	3.3	
Williston	1,875	14	44	27.95	29.89	— .03	64.6	— 3.9	95	22	77	39	30	52	45	57	52	69	2.43	+ 0.3	12	7,754	se.	50	w.	7	9	10	12	5.4	
Upper Miss. Valley.							74.8	— 0.4									69	4.15	+ 0.4									4.1	
Minneapolis	.....	99	208	.....	.....	.....	69.4	— 2.2	92	7	78	51	30	61	26	.....	.....	.....	7.29	+ 3.5	8	8,130	n.	60	nw.	9	6	11	14	.....	
St. Paul	837	102	122	29.05	29.94	— .01	69.6	— 1.9	90	7	77	52	30	62	25	62	58	69	5.61	+ 2.3	8	5,266	nw.	46	nw.	9	12	11	8	4.8	
La Crosse	714	71	87	29.20	29.96	.00	71.7	— 1.2	90	7	80	47	31	63	27	.....	.....	.....	4.25	+ 0.2	9	4,896	s.	27	n.	9	12	15	4	4.4	
Davenport	606	71	79	29.32	29.95	— .02	74.4	— 0.6	95	9	84	55	13	65	26	67	64	72	4.47	+ 0.8	11	5,034	w.	32	nw.	10	13	16	2	3.7	
Des Moines	861	84	99	29.07	29.97	+ .01	74.3	— 0.2	94	9	84	55	31	64	27	66	62	70	3.62	+ 0.1	10	5,497	sw.	28	nw.	28	8	19	4	5.0	
Dubuque	698	100	117	29.24	29.98	+ .01	72.4	— 1.9	91	9	82	53	31	63	26	65	61	70	7.10	+ 2.8	9	4,666	nw.	38	nw.	9	10	15	6	4.8	
Keokuk	614	63	78	29.31	29.95	— .03	77.2	+ 0.3	96	10	87	57	13	67	28	67	62	66	1.27	— 2.8	7	5,074	sw.	30	se.	3	17	14	0	3.0	
Cairo	356	87	93	29.63	30.00	.00	79.4	+ 0.5	95	11	87	66	13	72	26	73	70	78	4.89	+ 1.4	11	4,927	sw.	42	w.	11	9	18	4	5.0	
Springfield, Ill.	644	82	93	29.32	29.99	+ .01	76.6	+ 0.6	97	9	87	58	13	66	27	67	63	65	1.59	— 1.2	6	5,943	nw.	34	nw.	11	17	9	5	3.7	
Hannibal	534	75	110	29.41	29.97	— .01	77.0	+ 0.3	96	10	87	57	13	67	27	.....	.....	.....	2.86	— 1.7	9	6,048	sw.	48	sw.	17	25	6	0	2.2	
St. Louis	567	111	210	29.38	29.98	— .01	80.8	+ 2.0	98	9	89	65	13	73	23	69	64	61	2.68	— 1.1	7	6,027	s.	34	w.	21	12	12	7	4.7	
Missouri Valley.							74.8	— 0.4									66	3.54	— 0.2									4.5	
Columbia, Mo.	784	11	84	29.15	29.95	— .03	77.3	+ 0.9	95	10	88	57	5	66	31	.....	.....	.....	2.36	— 1.9	11	4,692	s.	28	sw.	17	11	6	14	5.9	
Kansas City	963	78	95	28.97	29.97	.00	78.6	+ 1.1	97	10	87	60	31	70	25	69	65	66	3.10	— 1.1	9	5,682	se.	26	sw.	17	19	9	3	2.9	
Springfield, Mo	1,324	98	104	28.61	29.98	.00	76.8	+ 1.1	93	11	85	63	5	68	23	69	66	74	2.96	— 1.4	10	6,624	se.	39	s.	3	20	8	3	3.4	
Topeka	.....	81	89	.....	.....	.....	77.6	+ 0.2	98	10	88	55	31	68	27	.....	.....	.....	3.74	— 1.2	12	6,255	s.	39	sw.	3	14	11	6	4.3	
Lincoln	1,189	75	84	28.68	29.90	— .05	75.5	— 1.3	99	9	86	50	31	65	32	67	63	69	3.07	— 0.8	8	7,293	s.	43	w.	15	15	12	4	3.8	
Omaha	1,105	115	121	28.79	29.93	— .02	76.4	+ 0.2	98	9	86	56	31	67	26	67	62	66	2.67	— 2.1	12	5,731	s.	34	n.	20	10	14	7	4.5	
Valentine	2,598	47	54	27.23	29.89	— .04	71.6	— 1.7	98	27	82	50	31	61	33	62	58	66	3.95	+ 1.4	12	8,832	se.	42	e.	13	12	9	10	5.2	
Sioux City	1,135	96	164	28.75	29.94	— .01	72.5	— 1.8	93	7	82	51	31	63	27	.....	.....	.....	5.57	+ 2.2	11	8,545	s.	48	nw.	1	11	11	9	5.3	
Pierre	1,572	43	50	28.28	29.92	— .01	73.7	— 0.9	105	24	86	50	30	62	38	62	55	57	4.99	+ 2.8	12	6,665	se.	49	n.	26	9	14	8	5.1	
Huron	1,306	56	67	28.57	29.94	.00	70.2	— 0.7	97	27	83	44	30	58	40	61	56	67	1.61	— 1.5	6	8,574	se.	44	s.	5	19	8	4	3.7	
Yankton	1,233	42	49	28.64	29.93	— .01	72.5	— 1.1	95	25	83	48	31	62	30	.....	.....	.....	4.88	+ 1.1	13	5,083	e.	34	nw.	1	10	16	5	5.1	
Northern Slope.							67.8	— 1.6									61	2.45	+ 0.8									4.3	
Havre	2,505	46	53	27.32	29.93	+ .02	65.6	— 1.9	95	21	78	43	8	53	39	57	51	65	5.23	+ 3.0	10	5,986	w.	40	nw.	7	15	12	4	4.2	
Miles City	2,371	42	50	27.41	29.86	— .06	71.8	— 1.9	104	22	84	52	3	59	38	65	62	75	2.70	+ 1.3	7	5,037	nw.	40	nw.	7	22	6	3	3.2	
Helena	4,110	88	94	25.82	29.95	+ .02	63.5	— 3.7	89	21	75	39	7	52	33	50	40	49	1.90	+ 0.8	13	5,814	sw.	34	sw.	30	11	14	6	4.9	
Kalispell	2,965	45	51	26.92	29.94	+ .01	60.2	.....	90	22	72	40	8	48	38	51	44	64	1.70	.....	14	4,275	w.	24	sw.	1	18	10	3	3.4	
Rapid City	3,234	46	50	26.60	29.89	— .04	69.2	— 2.1	98	6	81	46	3	58	40	60	54	64	3.37	+ 1.7	13	5,518	w.	34	w.	24	13	12	6	4.6	
Cheyenne	6,088	56	64	24.09	29.92	.00	66.8	— 0.1	89	15	81	40	3	53	37	53	44	52	0.79	— 1.0	9	7,337	nw.	38	w.	31	5	18	8	5.7	
Lander	5,372	26	36	24.67	29.90	— .02	65.3	— 0.7	91	29	82	34	4	49	43	52	42	52	0.21	— 0.7	4	2,933	sw.	36	w.	6	14	15	2	3.7	
North Platte	2,821	43	52	27.08	29.94	+ .01	72.4	— 1.1	98	20	84	47	4	61	33	64	60	70	2.93	+ 0.2	9	6,533	se.	48	w.	28	9	19	3	4.8	
Middle Slope.							77.5	+ 1.2									60	1.88	— 1.0									3.7	
Denver	5,291	79	151	24.77	29.91	.00	73.5	+ 1.8	95	25	87	42	4	60	42	56	48	50	1.36	— 0.4	6	6,172	s.	37	w.	16	10	19	2	4.6	
Pueblo	4,685	80	86	25.32	29.89	— .02	75.0	+ 1.0	98	22	90	41	4	59	45	58	48	49	0.71	— 1.5	6	5,432	se.	41	nw.	13	14	16	1	3.7	
Concordia	1,398	42	47	28.49	29.92	— .03	77.1	0.0	98	10	88	53	31	66	31	68	64	68	5.22	+ 1.6	11	5,677	s.	32	se.	14	12	15	4	4.4	
Dodge	2,509	44	54	27.37	29.90	— .03	79.2	+ 1.6	105	22	93	50	4	66	37	66	60	59	0.59	— 2.5	7	8,866	s.	40	nw.	3	20	6	5	3.4	
Wichita	1,358	78	86	28.54	29.94	— .02	80.2	+ 1.8	105	22	92	58	4	69	32	70	66	67	1.46	— 1.8	6	6,600	s.	34	sw.	3	24	5	2	3.1	
Oklahoma	1,214	79	86	28.68	29.93	— .03	80.0	+ 1.0	101	24	90	60	4	70	27	70	66	67	1.97	— 1.7	3	8,504	s.	42	n.	4	17	13	1	3.1	
Southern Slope.							80.2	+ 0.8									68	2.34	— 0.2									3.7	
Abilene	1,738	45	54	28.16	29.91	— .02	82.2	— 0.5	100	25	93	67	30	72	30	69	64	61	1.29	— 0.4	2	6,114	se.	28	ne.	29	17	9	5	3.8	
Amarillo	3,676	10	49	26.26	29.88	— .04	78.2	+ 2.2	98	16	91	52	4	65	36	63	55	54	3.38	0.0	6	10,379	s.	60	nw.	17	18	13	0	3.6	
Southern Plateau.							79.4	— 0.6									33	0.92	— 0.5									2.4	
El Paso	3,762	10	110	26.14	29.79	— .05	82.8	+ 0.9	102	30	96	65	31	70	36	61	48	38	1.19	— 0.9	7	6,926	e.	43	sw.	15	21	10	0	2.2	
Santa Fe	7,013	47	50	23.37	29.85	— .03	70.6	+ 2.1	88	24	82	46	4	59	30	53	41	40	0.56	— 2.2	6	5,263	se.	31	se.	8	20	11	0	2.6	
Flagstaff	6,907	12	25	23.44	29.83	.00	66.2	— 1.5	92	12	82	49	4	51	44	52	.....	.....	3.01	+ 0.5	10	.....	sw.	.....	.....	.....	12	10	9	4.8	
Phoenix	1,108	50	56	28.66	29.77	— .01	90.0	— 0.2	108	11	104	70	1	76	38	66	50	32	0.70	— 0.3	5	3,634	w.	48	se.	25	21	7	3	2.5	
Yuma	141	16	50	29.61	29.75	— .01	90.0	— 1.5	111	5	104	69	18	76	38	69	57	41	0.04	— 0.1	1	4,682	sw.	23	s.	6	28	2	1	0.9	
Independence	3,910	51	58	25.92	29.82	— .01	76.6	— 3.7	98	30	90	54	8	64	31	51	22	14	0.00	— 0.1	0	6,864	se.	38	nw.	6	27	4	0	1.1	
Middle Plateau.							70.0	— 3.1									34	0.20	— 0.2									2.2	
Carson City	4,720	82	92	25.29	29.89	+ .02	63.6	— 4.4	89	28	80	35	7	47	41	47	34	37	0.00	— 0.2	0	5,150	w.	40	sw.	6	29	2	0	0.8	
Winnemucca	4,344	59	70	25.59	29.91	+ .01	66.2	— 5.2	90	*	83	33	7	50	44	52	40	42	T.	— 0.2	0	6,648	ne.	42	sw.	5	26	5	0	0.9	
Modena	5,479	10	43	24.64	29.86	.00	68.8	.....	93	28	86	39	4	52	44	47	25	26	0.14	.....	3	10,384	sw.	65	sw.	6	23	6	2	1.9	
Salt Lake City	4,366	105	110	25.59	29.87	— .03	73.6	— 1.9	96	13	86	46	3	61	33	53	37	30	0.14	— 0.4	1	5,330	se.	47	n.	1	18	10	3	3.4	
Grand Junction	4,608	43	51	25.37	29.88	— .01	76.8	— 1.0	98	12	90	48	4	64	36	57	43	37	0.67	+ 0.1	6	4,701	e.	28	sw.	6	11	19	1	3.8	
Northern Plateau.							68.1	— 3.0									49	0.54	+ 0.1									3.4	
Baker City	3,471	53	59	26.45	29.99	+ .04	62.8	— 3.2	95	21	76	38	7	50	37	49	37	45	0.21	— 0.4	4	4,146	nw.	29	nw.	4	16	12	3	3.6	
Boise	2,739	61	68	27.12	29.93	.00	70.0	— 3.1	99	22	85	44	3	55	38	53	40	40	0.07	— 0.1	1	3,562	nw.	26	sw.	6	20	8	3	2.9	
Lewiston	757	52	61	29.14	29.93	— .02	72.0	— 2.0	105	22	86	48	6	58	41	.....	.....	.....	0.85	+ 0.3	6	3,276	e.	33	w.	1	22	6	3	2.7	
Pocatello	4,482	46	54	25.47	29.89	— .03	68.0	— 2.3	93	12	82	40	8	54	42	53	42	42	0.41	0.0	5	6,459	e.	36	w.	1	17	14	0	3.1	
Spokane	1,929	101	110	27.95	29.97	+ .01	65.5	— 3.5	97	21	78	43	5	53	39	53	43	52	1.13	+ 0.4	8	4,352	s.	24	sw.	1	11	9	11	5.2	
Walla Walla	1,000	65	71	28.90	29.96	— .01	70.4	— 3.6	101	21	83	47	14	57	40	58	50	54	0.60	+ 0.3	5	4,607	s.	33	ne.	19	21	10	0	2.7	
N. Pac. Coast Reg.							59.3	— 2.0									77	0.86	— 0.1									5.6	
North Head	211	11	56	29.88	30.10	+ .02	56.0	— 2.5	61	8	58	49	5	54	8	54	53	90	0.91	— 0.2	10	11,521	nw.	46	nw.	4	5	3	23	7.6	
Port Crescent	259	12	29	29.84	30.08	+ .02	54.2	— 2.1	84	20	60	40	15	48	40	.....	.....	.....	0.79	+ 0.2	5	3,094	w.	12	w.	1	10	16	5	4.8	
Seattle	123	114	151	29.96	30.09	+ .05	61.9	— 2.2	82	20	70	49	5	54	28	55	50	71	1.28	+ 0.6	6	4,425	w.	24	s.	1	12	12	7	4.7	
Tacoma	213	113	120	29.84	30.06	.00	60.8	— 1.2	81	16	70	48	14	52	31	.....	.....	.....	0.80	0.0	8	3,985	n.	23	sw.	1	8	12	11	6.0	
Tatoosh Island	86	7	57	29.99	30.09	+ .04	54.7	— 0.8	64	20	58	47	20	51	17	53	52	92	1.30	— 0.8	13	7,473	w.	52	s.	1	6	4	21	7.5	
Portland, Oreg.	154	68	96	29.91	30.07	+ .02	64.2	— 2.1	91	20	74	48	14	54	33	56	51	66	0.51	— 0.1	8	3,809	nw.	27	sw.	1	11	11	9	5.0	
Roseburg	518	56	67	29.51	30.06	+ .03	63.0	— 3.3	88	10	76	42	14	50	39	54	48	65	0.40	— 0.1	6	3,353	nw.	18	n.	31	16	10	5	3.8	
Mid. Pac. Coast Reg.							62.0	— 2.5									65	0.01	0.0									5.2	
Eureka	62	62	80	30.03	30.09	+ .04	54.7	— 1.1	64	23	58	47	14	51	13	52	49	84	0.06	0.0	2	5,265	nw.	40	n.	2	5	14	12	5.8	
Mount Tamalpais	2,375	11	18	27.54	29.97	+ .02	65.6	.....	88	31	73	44	6	58	22	50	36	40	0.01	.....	1	11,241	nw.	71	nw.	5	24	7	0	1.3	
Red Bluff	332	50	56	29.56	29.91	+ .02	75.9	— 5.9	101	31	91	54	6	61	38	57	41	34	0.00	0.0	0	4,126	se.	35	n.	2	30	1	0	0.5	
Sacramento	69	106	117	29.83	29.90	+ .02	69.4	— 3.2	95	31	84	50	13	54	38	57	49	57	0.00	0.0	0	7,266	s.	40	nw.	2	29	2	0	0.5	
San Francisco	155	161	167	29.84	30.01	+ .06	57.2	— 1.1	91	2	64	48	9	51	31	53	50	83	0.00	0.0	0	9,920	w.	37	w.	18	15	13	3	3.6	
Point Reyes Light	490	7	50	29.43	29.94	.....	52.8	— 1.0	64	22	57	46	9	49	15	.....	.....	.....	0.00	.....	0	19,828	nw.	80	nw.	5	7	11	13	6.1	
Southeast Farallon	30	9	17	29.97	29.99	.....	54.4	.....	64	23	56	49	9	52	8	53	53	94	0.00	.....	0	13,863	nw.	55	nw.	1	16	7	8	4.3	
S. Pac. Coast Reg.							68.2	— 2.4									67	0.00	0.0									1.9	
Fresno	330	67	70	29.53	29.88	+ .05	77.4	— 4.1	103	4	95	52	6	60	39	58	41	35	0.00	0.0	0	4,652	nw.	21	nw.	1	29	2	0	0.8	
Los Angeles	338	116	123	29.56	29.91	+ .01	68.4	— 0.9	88	14	80	52	25	57	30	59	56	74	0.00	0.0	0	3,788	w.	16	w.	13	11	20	0	2.8	
San Diego	87	94	102	29.82	29.92	.00	66.2	— 0.9	78	13	71	59	1	62	16	62	60	84	0.00	0.0	0	4,627	nw.	22	nw.	13	27	5	0	2.3	
San Luis Obispo	201	46	48	29.78	29.99	+ .04	61.0	— 3.7	87	2	73	42	13	49	37	53	49	74	0.00	0.0	0	3,762	w.	19	w.	6	31	0	0	1.8	
West Indies.																													
Basseterre †	29	41	54	29.98	30.00	+ .01	81.6	.....	89	27	87	72	11	76	15	75	73	73	1.42	.....	11	5,952	e.	30	s.	20	8	12	3	4.7	
Bridgetown	30	57	65	29.94	29.97	+ .03	80.6	+ 1.9	88	31	86	71	23	76	14	76	74	79	6.14	+ 1.1	20	6,424	e.	25	e.	14	9	13	9	5.2	
Cienfuegos ‡	52	62	67	29.94	29.99	.00	80.6	.....	94	18	90	69	11	71	23	74	72	80	6.02	.....	19	4,350	ne.	24	se.	5	4	24	2	5.0	
Curacao. §	.....	.....	.....	29.83	29.91	+ .02	82.2	.....	88	17	87	74	30	78	13	75	73	78	0.19	.....	4	8,585	e.	28	e.	9	10	13	2	4.6	
Grand Turk	11	6	20	30.02	30.03	+ .01	83.9	.....	92	*	90	70	31	78	19	.....	.....	.....	0.67	.....	7	.....	e.	.....	.....	.....	20	11	0	3.4	
Havana	57	87	105	29.94	30.00	.00	80.2	— 2.2	91	22	88	66	11	73	21	.....	.....	.....	5.58	+ 0.5	18	6,421	e.	48	e.	11	14	15	2	4.3	
Puerto Principe	352	55	62	29.65	30.01	+ .01	80.0	.....	93	13	90	67	24	70	26	74	73	85	4.65	.....	16	5,093	e.	36	e.	30	11	16	4	4.6	
San Juan	82	48	90	29.93	30.02	+ .03	80.7	— 0.6	89	17	86	72	10	75	15	76	74	80	7.13	+ 1.4	20	8,563	e.	35	e.	9	9	15	7	5.1	
Santo Domingo. ‖	57	37	44	29.96	30.03	.....	79.2	.....	92	20	86	67	6	72	20	74	73	85	9.05	.....	19	3,460	n.	18	se.	10	10	13	5	4.7	

* More than one date. † Record for last 23 days. ‡ Record for last 30 days. § Record for last 25 days. ‖ Record for last 28 days.

TABLE II.—*Climatological record of voluntary and other cooperating observers, June, 1903.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Anniston	94[c]	56[c]	76.4[c]	4.77	
Ashville	95	56	78.2	3.68	
Benton	.....	.....	.....	3.81	
Bermuda	100[c]	61[c]	81.1[c]	4.55	
Birmingham	97	63	81.0	7.13	
Bridgeport	.....	.....	.....	2.42	
Burkeville	.....	.....	.....	3.20	
Calera	.....	.....	.....	7.15	
Camphill	99	60	80.2	3.24	
Citronelle	98	66	80.8	3.89	
Clanton	93	60	78.2	5.04	
Cordova	98	56	79.8	3.88	
Daphne	97	66	81.5	7.22	
Decatur	98	61	80.8	2.47	
Demopolis	.....	.....	.....	1.90	
Dothan	100	60	82.2	2.22	
Eufaula	95	63	79.9	4.64	
Eutaw	100[d]	67[d]	83.0[d]	1.93	
Evergreen	102	62	80.7	6.62	
Flomaton	99[c]	59[c]	79.4[c]	4.59	
Florence *a*	.....	.....	.....	3.48	
Florence *b*	95	54	79.0	4.66	
Fort Deposit	99	64	81.6	3.53	
Gadsden	98	58	80.4	4.56	
Goodwater	98	61	79.5	2.36	
Greensboro	.....	.....	.....	3.67	
Haleyville	95	60	79.2	1.25	
Hamilton	98	57	80.1	1.32	
Helena	.....	.....	.....	4.90	
Highland Home	96	60	79.5	5.35	
Letohatchie	.....	.....	.....	3.42	
Livingston	98	62	80.6	4.52	
Lock No. 4	102	58	79.7	5.11	
Madison Station	99	59	81.4	4.83	
Maplegrove	100	55	77.6	3.89	
Marion	99	63	82.0	3.58	
Milstead	.....	.....	.....	3.95	
Newbern	100	61	83.0	2.43	
Notasulga	.....	.....	.....	4.27	
Oneonto	91	56	77.2	5.56	
Opelika	96	64	79.8	3.60	
Ozark	98	65	79.9	5.37	
Prattville	96	59	79.9	3.07	
Pushmataha	96	61	80.2	3.20	
Riverton	100	55	78.8	4.22	
Scottsboro	96	56	78.7	4.09	
Selma	99	63	81.8	3.32	
Talladega	100	58	81.0	4.22	
Tallassee	.....	.....	.....	3.60	
Thomasville	100	63	82.4	4.00	
Tuscaloosa	100	62	82.0	3.63	
Tuscumbia	96	61	81.0	3.01	
Tuskegee	100	65	81.2	3.88	
Union Springs	97	63	80.2	4.89	
Uniontown	97	62	80.4	4.07	
Valleyhead	95	54	77.0	4.19	
Verbena	.....	.....	.....	5.03	
Wetumpka	97	61	81.0	5.93	
Alaska.					
Coal Harbor	64	34	46.8	2.05	
Sitka	77	42	55.1	2.85	
Skagway	79	41	58.4	0.02	
Arizona.					
Agua Caliente	112	68	91.5	0.09	
Allaire Ranch	.....	.....	.....	1.11	
Arizona Canal Co's Dam	112	65	90.0	0.79	
Ashfork	96	38	69.6	.....	
Aztec	114	72	96.0	T.	
Benson	105	54	81.8	2.88	
Bisbee	96	61	77.6	1.20	
Bowie	.....	.....	.....	0.25	
Casagrande	115	74[f]	94.8[c]	0.60	
Cochise[e1]	110	67	80.0	0.86	
Congress	102	62	85.4	1.54	
Dragoon[e1]	95	70	80.2	0.40	
Dudleyville	107	58	85.4	1.09	
Duncan	104	45	79.2	0.61	
Fort Apache	97	44	74.0	0.72	
Fort Defiance	90	33	67.1	0.55	
Fort Grant	101	66	81.4	0.12	
Fort Huachuca	95	62	81.2	3.76	
Fort Mohave	113	67	91.2	T.	
Gilabend	114	.....	.....	0.57	
Greaterville	93	57	75.0	2.98	
Jerome	99	52	79.4	2.90	
Kingman	102	60	82.4	0.26	
Maricopa	112	65	91.0	0.25	
Mesa	111	65	89.6	1.05	
Mesa (near)	111	59	89.2	1.05	
Mohawk Summit[e1]	117	83	96.4	0.22	
Natural Bridge	.....	.....	.....	1.46	
Nogales	100	57	80.4	1.90	
Oracle	96	62	81.0	3.60	
Oro	.....	.....	.....	0.99	
Parker	116	66	91.2	0.12	
Phoenix	110	60	88.6	1.69	
Pinal Ranch	.....	.....	.....	0.53	
Prescott	95	40	65.8	3.13	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
San Carlos	111	57	87.5	1.69	
San Simon	105	54	82.5	1.21	
Sentinel[e1]	114	77	94.9	0.50	
Signal	114	56	87.0	0.13	
Superstition	.....	.....	.....	0.40	
Taylor	98	44	73.3	0.66	
Tombstone	100	53	79.2	3.09	
Tuba	100	52	76.3	0.60	
Tucson	106	61	85.8	1.52	
Upper San Pedro	102	54	79.3	0.25	
Vail[e5]	100	74	84.4	0.14	
Walnutgrove	.....	.....	.....	2.19	
Wilcox	104	43	75.1	0.86	
Yarnell	.....	.....	.....	3.39	
Young	.....	.....	.....	1.06	
Arkansas.					
Alco	95	59	77.6	4.42	
Amity	95	61	78.4	2.90	
Arkadelphia	98	64	80.2	4.49	
Arkansas City	.....	.....	.....	4.08	
Batesville	98	64	80.3	1.70	
Beebranch	97[c]	64[c]	79.0[c]	2.75	
Blanchard	96	59	79.2	4.49	
Brinkley	96	62	79.8	5.32	
Camden *a*	.....	.....	.....	6.74	
Camden *b*	98	66	81.3	6.71	
Conway	103	63	80.9	3.68	
Corning	96	62	78.2	2.86	
Dallas	98	64	81.0	3.59	
Dardanelle	.....	.....	.....	2.62	
Dodd City	98	53	77.5	2.49	
Elon	98[c]	57[c]	79.4[c]	4.10	
Eureka Springs	93	60	77.5	1.83	
Fayetteville	94	57	77.4	2.24	
Forrest City	95	64	81.0	4.53	
Fulton	.....	.....	.....	3.44	
Hardy	98	62	79.0	3.01	
Helena *a*	.....	.....	.....	5.64	
Helena *b*	98	60	81.2	4.80	
Jonesboro	99	60	80.7	3.27	
Lacrosse	99	68	79.2	2.22	
Lake Village	96	59	80.0	5.13	
Lonoke	97	63	79.4	5.22	
Lutherville	95	59	77.2	4.36	
Malvern	100	64	80.6	5.00	
Marvell	98	62	80.8	3.88	
Mossville	89	60	74.6	2.53	
Mount Nebo	92	66	78.8	2.41	
New Gascony	99	61	79.5	3.22	
Newport *a*	.....	.....	.....	4.82	
Newport *b*	101	62	81.2	4.61	
Oregon	103	56	73.8	4.98	
Ozark	97	64	80.0	2.58	
Paragould	97	62	80.6	2.36	
Perry	99	62	80.2	4.57	
Pinebluff	99	61	80.6	6.44	
Pocahontas	99	61	80.4	4.08	
Pond	95	54	78.0	1.45	
Prescott	98	65	82.4	8.27	
Princeton	96	61[f]	78.7[c]	4.65	
Rison	97	58	78.6	2.27	
Rosadale	100	64	81.4	4.06	
Russellville	103	63	81.8	2.23	
Silversprings	94	58	77.4	1.31	
Spielerville	103	67	84.2	2.48	
Stuttgart	97	62	79.6	6.67	
Texarkana	100	63	81.4	1.75	
Warren	99	59	81.0	5.85	
Washington	92	65	78.2	5.63	
Wiggs	97	61	78.7	7.53	
California.					
Angiola	103	44	74.7	0.00	
Azusa *g*	98	48	71.5	0.00	
Bagdad	112	73	93.3	0.00	
Bakersfield	107	46	76.2	0.00	
Ballast Point L. H	.....	.....	.....	0.00	
Barstow	108	50	80.0	0.00	
Bear Valley	.....	.....	.....	0.00	
Berkeley	94	47	61.0	0.00	
Bishop	98	40	69.9	0.00	
Boca[e1]	86	32	55.5	0.00	
Bodie	85	15	51.4	0.00	
Bowman	88	44	64.6	0.00	
Branscomb	95	38	63.7	T.	
Caliente[e1]	104	70	86.1	0.00	
Campbell	96	39	62.8	0.00	
Campo	.....	.....	.....	0.00	
Cape Mendocino L. H	.....	.....	.....	0.00	
Cedarville	95	33	64.6	0.19	
Chico	104	48	73.8	0.00	
Cisco[e1]	75	46	63.3	0.00	
Claremont	107	42	72.4	0.00	
Cloverdale	104	42	70.0	0.00	
Colusa	100	52	73.0	0.00	
Corning[e1]	100	65	77.8	0.00	
Coronado	82	59	68.2	0.00	
Crescent City	70	39	56.2	0.14	
Crescent City L. H	.....	.....	.....	0.25	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cuyamaca	84	41	64.4	0.00	
Delano[e1]	102	64	83.8	0.00	
Delta[e5]	103	60	74.3	0.00	
Drytown	100	46	70.6	0.00	
Dunnigan[e5]	104	57	79.6	0.00	
Durham	104	45	73.5	0.00	
East Brother L. H	.....	.....	.....	0.00	
Elcajon	100	47	71.6	0.00	
Elmdale	107	41	73.1	0.00	
Escondido	102	38	70.2	0.00	
Fallbrook	99	48	71.8	0.00	
Fordyce Dam	.....	.....	.....	0.00	
Fort Ross	79	40	56.7	0.00	
Foster	.....	.....	.....	0.00	
Georgetown	95	40	69.6	0.00	
Gilroy (near)	97	40	64.2	0.00	
Greenville	95	44	71.0	0.00	
Hanford	105	45	75.5	0.00	
Healdsburg	108	41	67.9	0.00	
Hollister	96	40	63.8	0.00	
Humboldt L. H	.....	.....	.....	0.00	
Idylwild	87	41	64.9	0.00	
Imperial	121	72	94.9	T.	
Iowa Hill[e1]	88	52	69.5	0.00	
Irvine	92	60	72.3	0.00	
Jackson	96	46	71.4	0.00	
Jamestown	97	42	70.5	0.00	
Jolon	.....	.....	.....	0.00	
Kennedy Gold Mine	90	41	65.6	0.00	
Kentfield	95[c]	42[c]	62.8[d]	0.00	
Laguna Valley	.....	.....	.....	0.00	
Lakeport (near)	93	50	71.4	0.00	
Laporte	82	32	58.0	0.00	
Legrande	.....	.....	.....	0.00	
Lemoncove	107	53	78.5	0.00	
Lick Observatory	84	39	64.0	0.00	
Lime Point L. H	.....	.....	.....	0.00	
Livermore	100	45	68.0	0.00	
Lodi	100	45	69.4	0.00	
Los Gatos	98	43	65.8	0.00	
Mammoth	111	68	90.8	T.	
Mare Island L. H	.....	.....	.....	0.00	
Marysville	104	50	73.2	0.00	
Meadow Valley[e1]	88	37	59.9	0.00	
Merced	98	54	77.7	0.00	
Mercury	104	40	66.6	0.00	
Mills College	.....	.....	.....	0.00	
Milo	.....	.....	.....	0.00	
Milton (near)	99	49	72.6	0.00	
Modesto[e1]	103	60	76.1	0.00	
Mohave	102	60	83.8	0.00	
Mokelumne Hill[e5]	.....	50	66.6	0.00	
Montague	98	39	66.7	0.25	
Monterio	92	50	70.6	0.00	
Monterey	79	50	60.5	0.00	
Mount St. Helena	.....	.....	.....	0.00	
Napa	104	44	65.8	0.00	
Needles	112	78	97.2	0.00	
Nevada City	94	37	64.8	0.00	
Newman	107	48	76.6	0.00	
Niles	96	44	65.2	0.00	
North Bloomfield	95	39	67.4	0.00	
North San Juan	97	44	68.9	0.00	
Oakland	94	49	63.0	0.00	
Ogilby[e5]	115	85	98.2	0.00	
Ontario	98	48	73.0	0.00	
Orland	103	51	76.8	0.00	
Orleans	104	46	74.0	0.16	
Oroville (near)	103	47	74.8	0.00	
Palermo	104	45	72.4	0.00	
Paso Robles	100	37	67.0	0.00	
Peachland[e5]	94	50	65.0	0.00	
Piedras Blancas L. H	.....	.....	.....	0.00	
Pigeon Point L. H	.....	.....	.....	0.00	
Pine Crest	88	50	67.6	0.00	
Placerville	92	40	66.4	0.00	
Point Ano Nuevo L. H	.....	.....	.....	0.00	
Point Arena L. H	.....	.....	.....	0.00	
Point Bonita L. H	.....	.....	.....	0.00	
Point Conception L. H	.....	.....	.....	0.00	
Point Fermin L. H	.....	.....	.....	0.00	
Point Hueneme L. H	.....	.....	.....	0.00	
Point Lobos	72	48	55.6	0.00	
Point Loma L. H	.....	.....	.....	0.00	
Point Montara L. H	.....	.....	.....	0.00	
Point Pinos L. H	.....	.....	.....	0.00	
Point Sur L. H	.....	.....	.....	0.00	
Porterville	104	46	76.2	0.00	
Poway	.....	.....	.....	0.00	
Quincy	89	35	62.4	0.00	
Redding	100	54	75.6	0.00	
Redlands	103	50	75.2	0.00	
Reedley	107	50	80.8	0.00	
Represa	92	52	71.8	0.00	
Riovista	97	51	70.2	0.00	
Riverside	99	45	71.6	T.	
Roe Island L. H	.....	.....	.....	0.00	
Rohnerville	73	38	59.8	0.11	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rosewood	103	48	74.2	0.00	
Sacramento	94	50	69.2	0.00	
Salinas	88	42	59.9	0.00	
Salton*[1]	118	66	87.8	0.00	
San Bernardino	102	42	73.4	0.00	
San Jacinto	102	50[1]	76.6[4]	0.00	
San Jose	98	42	64.9	0.00	
San Leandro	96	45	63.1	0.00	
San Luis L. H				0.00	
San Mateo*[1]	95	57	66.7	0.00	
San Miguel*[1]	100	50	74.6	0.00	
San Miguel Island	69	50	57.2	0.00	
Santa Barbara	82	51	65.2	0.00	
Santa Barbara L. H				0.00	
Santa Clara				0.00	
Santa Clara College	99	40	64.0	0.00	
Santa Cruz	96	38	69.1	0.00	
Santa Cruz L. H				0.00	
Santa Maria	82	42	62.3	0.00	
Santa Monica	81	51	64.2	0.00	
Santa Paula	93	50	72.8	0.00	
Santa Rosa	102	40	64.2	0.00	
Shasta	104	50	77.3	0.00	
Sierra Madre	91	52	70.8	0.00	
Sisson	101	33	65.2	T.	
Sonoma				0.00	
S. E. Farallon L. H				0.00	
Stockton	96	50	69.6	0.00	
Storey	104	48	74.9	0.00	
Summerdale	83	41	63.0	0.00	
Susanville	88	34	62.7	0.00	
Tehama*[1]	100	62	79.2	0.00	
Tejon Ranch	98	53	77.1	0.00	
Trinidad L. H				0.00	
Truckee*[1]	94	46	62.4	0.00	
Tulare c	106	48	75.6	0.00	
Tustin	87	67	76.5	0.00	
Ukiah	104	39	68.6	0.00	
Upland	93	49	71.0	0.00	
Upperlake	100	40	68.4	0.00	
Upper Mattole				0.00	
Vacaville*[1]	100	57	72.0	0.00	
Visalia	105	45	75.0	0.00	
Volcano Springs	117	65	90.9	0.00	
Wasco	105	52	79.0	0.00	
Wheatland	101	48	72.2	0.00	
Williams*[1]	98	61	81.1	0.00	
Willits	100	42	69.8	0.00	
Willow	99	52	73.8	0.00	
Yerba Buena L. H				0.00	
Zenia	90	34	62.1	0.00	
Colorado.					
Alford	88	38	64.8	1.27	
Antelope Springs	84	23	56.7	1.66	
Ashcroft	78	25	55.2	2.11	
Blaine	111	55	81.6	0.97	
Boulder	92	40	71.0	0.95	
Boxelder				2.77	
Breckenridge	79	28	55.2	1.72	
Buenavista				0.03	
Canyon	97	35	71.8	1.05	
Castlerock	91	32	68.4	1.53	
Cheesman	93	36	68.0	1.39	
Clearview	78	31	57.1	2.67	
Colorado Springs	88	37	68.6	0.43	
Collbran	92	36	68.2	1.66	
Durango	92[1]	36[b]	68.0[f]	2.82	
Fort Morgan	95	41	71.8	2.22	
Fox	99	42	74.0	3.68	
Fruita	99	39	74.0	0.81	
Garnett	86	33	62.0	0.62	
Gilman				2.18	0.5
Gleneyre	92	33	67.4	1.25	
Glenwood Springs	91	30	65.8	1.11	
Greeley	98	37	71.8	1.25	
Grover				2.90	
Gunnison	87	29	59.8	0.87	
Hamps	93	35	68.5	1.99	
Hoehne	92	30	69.8	0.83	
Holly	102	58	79.1	2.29	
Holyoke (near)	102	43	73.2	2.43	
Husted	92	30	65.9	1.03	
Lake Moraine	73	29	54.4	4.60	T.
Lamar	102	42	78.4	1.58	
Laporte				2.57	
Las Animas	102	53	76.7	1.10	
Leadville (near)				0.58	0.2
Leroy	98	41	72.4	1.71	
Longs Peak	76	31	55.5	2.00	4.0
Mancos	89	30	65.4	1.59	
Marshall Pass				0.09	
Meeker	94	30	65.6	1.40	
Montrose				0.91	
Moraine	82	32	59.9	1.05	
Pagoda	89	31	62.8	0.55	
Parachute	98	35	72.2	1.05	
Platte Canon				0.79	
Rangely	93	33	66.8	0.98	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rockyford	101	41	75.4	0.42	
Rogers Mesa	96	40	71.5	1.05	
Russell	83	26	57.6	1.32	
Saguache	89	34	63.8	0.54	
Salida	90	33	64.6	0.99	
San Luis	91	36	62.4	1.19	
Santa Clara	90	32	65.4	3.22	
Sapinero				1.25	
Silt	92	34	69.8	0.88	
Sugarloaf	92	33	65.6	2.57	T.
Trinidad	91	42	71.8	1.17	
Twinlakes				0.50	
Vilas				0.52	
Wallet				5.03	
Waterdale	94	35	67.4	1.25	
Whitepine	76	24	53.6	2.64	
Wray	99	44	74.2	5.16	
Yuma				2.65	
Connecticut.					
Bridgeport	96	52	73.2	2.79	
Canton	90	46	68.2	3.86	
Colchester	92	44	69.9	3.72	
Falls Village				2.64	
Hartford	92	50	71.3	6.58	
Hawleyville	92	44	69.8	2.56	
Lake Konomoc				3.33	
New London	94	56	72.3	2.00	
North Grosvenor Dale	95	45	69.4	3.51	
Norwalk	97	45	71.4	3.03	
Southington	91	43	70.2	3.65	
South Manchester				4.40	
Storrs	90	45	68.6	4.56	
Voluntown	93	46	69.0	2.94	
Wallingford				2.46	
Waterbury	95	48	72.2	3.71	
West Cornwall	90	45	68.8	4.07	
West Simsbury				3.79	
Delaware.					
Delaware City				3.73	
Milford	99	52	76.6	3.93	
Millsboro	98	53	75.6	5.47	
Newark	95	50	73.0	3.98	
Seaford	100	52	76.0	3.91	
District of Columbia.					
Distributing Reservoir*[b]	91	64	77.4	3.56	
Receiving Reservoir*[b]	94	62	76.7	5.21	
West Washington	98	53	76.3	5.69	
Florida.					
Archer	95	64	80.4	9.64	
Avon Park	98	67	82.2	6.61	
Bartow	94	70	81.6	9.16	
Bonifay	99	65	81.0	4.35	
Carrabelle	95	69	81.3	5.18	
Clermont	97	68	82.0	8.04	
De Funiak Springs	98	65	80.0	7.05	
Deland	95	67	81.2		
Eustis	98	68	82.5	5.73	
Federal Point	96	65	80.8	5.30	
Fernandina	98	69	81.2	1.17	
Fort George*[1]	97	74	81.9		
Fort Meade	99	64	82.0	8.46	
Fort Myers	92	70	80.2	11.40	
Fort Pierce	96	61	79.2	4.60	
Gainesville	97	66	81.0	5.72	
Grasmere	97	68	82.8		
Huntington	100	65	82.6	2.92	
Hypoluxo	91	70	80.6	5.94	
Inverness	97	65	80.9	12.67	
Jasper	90	72	80.4	5.04	
Johnstown	97	65	80.7	8.33	
Kissimmee	95[d]	68	80.4	6.07	
Lake City	99	65	81.1	7.93	
Macclenny	102	61	81.8	9.27	
Madison	100	66	81.6	3.79	
Malabar	94	68	80.9	1.49	
Manatee	96	67	80.8	6.66	
Marco	95	70	82.6	8.72	
Marianna	96	62	80.2	4.69	
Merritt Island	90	71	81.6	2.78	
Middleburg	105	60	80.9	5.33	
Molino	102	60	80.3	7.31	
New Smyrna	91	68	78.4	2.29	
Nocatee	98	69	82.4	10.28	
Ocala	97	64	81.3	9.55	
Orange Home	96[d]	66[d]	81.0[d]	6.01	
Orlando	98	73	85.0	8.41	
Pinemount	101	66	81.5	8.42	
Plant City	97	66	81.6	9.24	
Quincy	99	60	81.4	4.20	
Rockwell	99	70	84.0	12.95	
St. Andrews	99	65	81.8	3.51	
St. Augustine	97	66	80.4	3.90	
St. Leo	96	63	80.4	7.25	
Stephensville	96	60	80.7	7.90	
Sumner	93	60	79.1	12.03	
Switzerland	95	64	80.2	7.45	
Tallahassee	94	68	80.2	7.09	
Tarpon Springs	95	65	81.0	4.46	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Titusville	91	67	79.8	5.02	
Waukeenah	97	67	80.7	6.65	
Wausau	101	64	81.9	5.86	
Wewahitchka	100	66	81.5	3.83	
Georgia.					
Abbeville				3.08	
Albany	99	64	82.2	8.83	
Allapaha	99	64	81.6	5.06	
Alpharetta	94	52	75.2	2.64	
Americus	99	65	82.0	3.93	
Athens	94	63	80.0	1.87	
Bainbridge	96	65	80.8	7.69	
Bowersville	97	60	79.4	3.59	
Butler				5.18	
Camak	99	63	81.2	1.78	
Canton				3.33	
Carlton				7.20	
Clayton	92	52	74.6	2.60	
Columbus	100	65	81.9	8.01	
Coney	101	63	81.6	3.61	
Covington	97	63	79.6	5.21	
Dahlonega	91	60	76.0	3.41	
Dawson	101	62	81.1	3.24	
Diamond	95	52	74.9	5.91	
Douglas	102	64	82.6	3.06	
Dublin				2.95	
Dudley	99	65	81.1	9.34	
Eastman	103	68	83.1	4.17	
Elberton	101	62	80.4	3.27	
Experiment	96	61	79.2	2.28	
Fitzgerald	99[c]	65[c]	81.4[c]	4.92	
Fleming	101	62[c]	81.4	3.10	
Forsyth	99	64	81.0	1.21	
Fort Gaines	100	66	81.6	3.02	
Gainesville	95	60	78.4	2.15	
Gillsville		60		2.95	
Greensboro	101	59	79.6	2.71	
Greenbush	93	58	78.4	4.59	
Griffin	97	60	79.0	4.01	
Harrison	97	63	80.7	3.56	
Hawkinsville	98	62	80.6	4.66	
Hephzibah	98			1.12	
Jesup	102	63	82.7	2.05	
Lost Mountain	95	61	77.8	3.97	
Louisville	98	64	81.0	2.57	
Lumpkin	100	63	81.0	3.92	
Marshallville	96	64	81.7	3.78	
Mauzy	97[c]	62[c]	80.3[c]	4.52	
Milledgeville	97	62	80.8	1.36	
Millen	102	61	81.8	5.61	
Monticello	101	60	81.4	1.31	
Morgan	98	61	78.8	5.37	
Naylor	100	64	81.9	5.48	
Newnan	98	61	79.4	4.97	
Oakdale				3.70	
Oakfield				6.15	
Point Peter	99	52	79.6	4.63	
Poulan	96	61	79.4	7.11	
Putnam	96[c]	61[c]	80.4[c]	3.16	
Quitman	98	68	81.7	6.19	
Ramsey	93	53	76.5	3.67	
Resaca				2.85	
Rome	96	58	79.4	3.25	
St. Marys	99	65	81.7	3.11	
Statesboro	100	64	81.2	4.38	
Stillmore	98[j]	63[j]	79.3[j]		
Talbotton	95	60	78.4	7.07	
Tallapoosa	93	56	76.8	2.55	
Thomasville	100	67	81.6	5.87	
Toccoa	95	59	78.8	4.69	
Valona	98	63	81.0	1.46	
Vidalia	99	65	82.1	3.67	
Washington	97	64	80.2	1.66	
Waverly	101	64	81.0	3.61	
Waycross	100	67	82.0	5.46	
Waynesboro	95	65	80.0	3.40	
Westpoint	102	60	82.2	4.15	
Woodbury	97	58	78.4	6.72	
Idaho.					
Albion	94	30	62.8	T.	
American Falls	98	35	67.1	0.38	
Blackfoot	101	36	69.2	T.	
Blue Lakes	98	40	70.2	0.22	
Burnside	93	29	62.2	0.50	
Cambridge	101[d]	38[d]	67.8[d]	0.98	
Chesterfield	90	27	58.5	0.30	
Dickey	92	33	62.2	2.50	
Forney	90	28	58.0	1.29	T.
Garnet	105	43	76.2	T.	
Grangeville	94	40	61.8	2.00	
Lake	80	30	53.3	1.80	
Lakeview	91	41	63.3	0.93	
Lost River	89	28	60.6	0.14	
Meadows	93	32	59.6	0.95	
Moscow	85	37	58.4	0.57	
Murray	98	36	60.8	2.16	
Oakley	96	31	66.1	T.	
Ola	99	37	66.6	0.67	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pollock	100	44	67.8	1.24	
Porthill	87	41	61.3	2.13	
Priest River	94	34	60.3	1.41	
Riddle	91	26	61.6	T.	
Roosevelt	82[b]	28[b]	50.4[b]	1.33	3.5
St. Maries	97	38	62.8	1.57	
Silver City	90[c]	27[c]	59.0[c]	0.20	
Soldier	94	28	60.6	0.60	
Vernon	90	31	60.8	0.19	T.
Weston	98	32	65.8	0.10	
Illinois.					
Albion	101	57	78.8	4.19	
Aledo	94	54	74.0	1.89	
Alexander	96	54	76.0	3.54	
Antioch	95	50	71.6	6.60	
Ashton	90	50	70.5	6.29	
Astoria	96	53	74.0	4.03	
Aurora	94	50	72.4	5.59	
Beardstown				3.30	
Benton	102	56	81.0	1.60	
Bloomington	100	49	76.3	4.63	
Bushnell	99[c]	55[c]	77.2[c]	1.70	
Cambridge	95	56	74.6	2.95	
Carlinville	96	54	76.9	3.89	
Centralia	101	53	78.6	0.92	
Charleston	96	56	76.6	5.32	
Chester				4.39	
Chicago Heights				5.50	
Cisne	98	53	77.6	4.41	
Coatsburg	96	54	75.8	2.24	
Cobden	99	57	79.7	3.22	
Danville	99	52	76.6	1.19	
Decatur	98	52	76.2	4.57	
Dixon	94	53	73.4	4.91	
Equality	99	54	79.5	1.83	
Fandon	98	53	76.0	2.32	
Flora	96	53	76.3	3.89	
Friendgrove	96	54	77.4	3.31	
Galva	96	54	74.0	5.77	
Grafton				1.34	
Greenville	100	56	79.0	2.29	
Griggsville	99	59	79.3	2.10	
Halfway	97	60	79.8	2.78	
Halliday	99	54	76.0	2.51	
Havana	99[d]	56[d]	78.1[d]	3.02	
Henry	95	52	74.8	3.28	
Hillsboro	99	56	78.0	2.56	
Hoopeston	100	52	75.2	3.85	
Joliet	94	53	73.8	4.46	
Kishwaukee	94	40	71.0	5.25	
Knoxville	96	50	73.2	1.53	
Laharpe	98	50	75.6	1.45	
Lanark	92	46	70.0	9.09	
Loami				2.43	
McLeansboro	100	56	79.8	1.31	
Martinsville				3.06	
Martinton	96	50	74.2	4.34	
Mascoutah	96	56	77.3	3.83	
Mattoon	92	54	75.4	5.39	
Minonk	99	50	73.4	6.24	
Monmouth	98	49	71.8	1.92	
Morrison	91	52	71.6	7.40	
Morrisonville	97	56	76.1	4.59	
Mount Carmel				3.46	
Mount Pulaski	98	53	76.3	2.24	
Mount Vernon	99	54	79.8	0.94	
New Burnside	102	59	82.3	1.43	
Olney	102	58	78.9	4.46	
Ottawa	98	56	76.0	1.94	
Palestine	99	58	78.2	4.51	
Pana	97	56	75.8	3.53	
Paris	97	57	76.9	3.43	
Peoria *a*				5.07	
Peoria *b*	100	56	77.6	4.91	
Philo	96	52	74.5	3.49	
Plumhill	97	56	78.4	2.28	
Pontiac	95	55	75.1	6.35	
Rantoul	97	52	75.3	2.73	
Raum	100	55	79.5	2.76	
Riley	92	50	71.2	4.61	
Robinson				4.90	
Rockford	94	51	73.2	5.49	
Rushville	98	54	76.5	3.13	
St. Charles	95	51	72.2	6.89	
St. John	100	56	80.0	2.04	
Shobonier	98	54	79.0	2.93	
Streator		52		2.43	
Sullivan	95	55	75.4	4.91	
Sycamore	97	50	72.9	7.14	
Tilden	100	54	78.8	1.35	
Tiskilwa	92	53	72.8	2.24	
Tuscola	96	54	75.8	3.97	
Urbana	96	54	74.8	5.13	
Walnut	96	53	73.9	5.38	
Winchester	97	56	77.0	3.30	
Winnebago	94	50	71.6	4.93	
Yorkville	97	50	73.2	5.07	
Zion	93	49	71.4	9.45	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana.	°	°	°	*Ins.*	*Ins.*
Anderson	95	52	74.8	2.98	
Angola	91	47	71.0	5.66	
Auburn	92	45	70.6	2.62	
Bloomington	100	59	76.8	3.90	
Butlerville	96	50	76.0	1.49	
Cambridge City	93	49	72.7	7.10	
Columbus	98	50	75.4	2.73	
Connersville	94	49	73.6	4.12	
Crawfordsville	101	55	78.2	1.55	
Delphi	100	49	74.5	1.56	
Elkhart	94	52	73.6	6.26	
Farmland	93	50	74.9	2.06	
Fort Wayne	92	51	72.6	4.85	
Franklin*[1]	95	62	75.6	6.77	
Greencastle	94	56	75.2	3.36	
Greensburg	96	49	75.2	6.13	
Hammond	93	51	71.0	2.69	
Hector	96	50	73.6	2.95	
Holland	98	53	77.8	3.14	
Huntington	93	50	72.5	7.39	
Jeffersonville	98	57	78.7	1.10	
Kokomo	97	51	74.6	1.15	
Lafayette	100	53	74.2	2.68	
Laporte	95	50	71.9	5.73	
Logansport	97	51	74.7	5.29	
Madison *a*	100	53	78.4	1.52	
Madison *b*				1.39	
Marengo	100	52	77.0	0.82	
Marion	96	47	74.0	2.14	
Markle	92	46	71.2	6.30	
Mauzy	95	52	73.6	5.21	
Moores Hill	96	52	76.0	2.49	
Mount Vernon	100	56	80.1	2.06	
Northfield	97	49	73.2	1.74	
Paoli	98	52	76.7	1.50	
Princeton	99	54	78.0	2.45	
Rensselaer	95	50	72.7	4.85	
Richmond	93	48	72.8	3.04	
Rockville	94	55	75.0	2.04	
Rome	98	49	77.7	3.62	
Salem	100	50	77.0	1.60	
Scottsburg	98	57	77.7	1.63	
Seymour	96	54	76.4	1.90	
South Bend	93	48	72.4	6.43	
Syracuse	96	46	73.4	4.80	
Terre Haute	98	58	77.9	2.15	
Topeka	91	48	69.9	5.25	
Valparaiso	93	46	72.4	8.46	
Veedersburg [b]	96	51	76.1		
Vevay	97	56	77.0	4.20	
Vincennes	100	57	76.8	3.34	
Washington	98	51	76.1	2.63	
Winamac	98	47	73.4	4.18	
Worthington	99	51	75.3	2.18	
Indian Territory.					
Ardmore	103	59	81.0	2.90	
Chickasha	107	60	83.3	1.90	
Durant	105	65	83.1	10.89	
Fairland	94	56	78.4	2.73	
Goodwater	100	61	80.6	3.70	
Hartshorne	96	55	80.4	2.54	
Healdton	105	60	81.1	0.51	
Holdenville	96	63	79.4	5.30	
Hugo	100	58	77.9	7.70	
Marlow	106	63	81.6	0.79	
Muskogee	95	61	79.3	4.29	
Pauls Valley	105	60	79.8	6.20	
Ravia	99	60	79.6	8.76	
Roff	100	64	79.5	7.95	
South McAlester	99	65	81.0	5.50	
Tahlequah				2.49	
Tulsa				4.35	
Wagoner	96	60	80.1		
Webbers Falls	98	63	80.3	3.25	
Iowa.					
Afton	97	48	74.8	3.88	
Albia	96	49	75.0	2.21	
Algona	92	49	72.2	2.77	
Allerton	94	50	74.0	3.92	
Alta	89	45	69.6	6.81	
Amana	94	51	73.5	2.47	
Ames	93	50	73.4	4.77	
Atlantic	97	44	74.2	3.68	
Baxter	94	50	73.1	3.61	
Bedford	94	48	74.0	2.48	
Belknap	96	55	76.0	0.94	
Belleplaine	93	50	72.6	4.47	
Bonaparte	96	53	75.4	2.74	
Britt	93	46	71.0	3.45	
Buckingham				2.41	
Burlington	94	55	75.6	1.82	
Carroll	95	44	72.2	5.59	
Cedar Rapids	96	52	73.8	4.94	
Chariton	93	50	72.9	4.43	
Charles City	93	44	71.0	7.36	
Chester	90	40	69.1	4.15	
Clarinda	98	48	75.6	2.02	
Clearlake	98	45	73.1	4.95	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Clinton	96	51	73.6	5.27	
College Springs	96	50	76.4	2.34	
Columbus Junction	95	53	74.2	1.58	
Corning	93	47	73.6	2.51	
Corydon	93	50	73.3	2.94	
Cumberland				6.69	
Danville				1.75	
Decorah	90	47	71.5	8.14	
Delaware	90	46	70.8	10.50	
Denison	86	49	70.8	5.28	
Desoto	92	50	73.0	4.44	
Dows	91	47	70.2	9.50	
Earlham	91	42	71.4	3.62	
Elkader	93	46	72.4	12.72	
Estherville	90	43	70.9	8.70	
Fayette	91	42	70.6	10.71	
Forest City	91	45	71.2	3.79	
Fort Dodge	89	45	70.0		
Fort Madison	95	61	77.7	1.70	
Galva	94	44	70.6	4.32	
Gilman				4.49	
Grand Meadow	87	48	68.8	10.85	
Greene	92	45	71.9	8.90	
Greenfield	92	48	73.0	2.43	
Grinnell	94	49	73.3	3.79	
Grundy Center	92	46	71.4	6.19	
Guthrie Center	95[c]	47	72.8	5.35	
Hampton	92	46	72.3	9.70	
Hanlontown	89	43	69.6	3.89	
Harlan	95	46	73.3	5.05	
Hopeville	95	49	74.1	2.21	
Humboldt	92	48	72.2	5.39	
Idagrove	92	46	72.2	6.41	
Independence [d]	90	47	70.5		
Indianola	94	52	75.0		
Iowa City	96	53	74.8	4.76	
Iowa Falls	92	45	71.2	6.58	
Jefferson				3.89	
Keosauqua	97	53	75.6	2.72	
Lacona				1.99	
Lansing	91	45	72.6	5.25	
Larchwood	94	45	71.0	5.83	
Larrabee	94	44	72.1	8.24	
Leclaire				4.54	
Lemars	92	45	71.4	5.46	
Lenox	92	49	73.8	4.23	
Leon	96	49	75.5	1.88	
Logan				4.96	
Maple Valley				6.23	
Maquoketa	93	48	72.2	7.68	
Marshalltown	96	46	73.8	6.12	
Mason City	93	49	72.4	5.94	
Monticello	93	46	74.1	8.40	
Mountayr	94	50	74.8	4.33	
Mount Vernon	96	49	73.8	4.10	
New Hampton	91[c]	45[c]	68.5[c]	8.08	
Newton	93	51	72.9	5.30	
Northwood	87	46	69.6	3.41	
Odebolt	97	44	73.4	4.87	
Ogden	95	45	71.5	5.09	
Olin	93	51	72.3	7.50	
Onawa	96	52	75.0	7.21	
Osage	90	45	69.9	6.39	
Osceola	95	49	74.4	2.45	
Oskaloosa	94	53	74.8	1.61	
Ottumwa	98	51	75.2	1.78	
Pacific Junction	97	50	75.2	2.88	
Perry	94	50	73.8	3.64	
Plover	93	44	71.0	5.30	
Primghar	88	41	70.0	4.52	
Redoak	94	55	76.2	2.34	
Ridgeway	98	50	73.5	6.12	
Rockwell City	95	48	72.2	6.64	
Sac City	95	46	71.9	7.26	
St. Charles	95	50	73.8	4.19	
Scranton	96	47	73.6	4.88	
Sheldon	90[c]	43[c]	70.4[c]	6.22	
Sibley	89	45	69.4	5.93	
Sigourney	100	50	76.0	2.71	
Sioux Center	90	45	70.4	2.70	
Stockport				2.53	
Storm Lake	89	46	70.2	5.83	
Stuart	96	50	75.4	3.18	
Thurman	100	47	76.0	3.06	
Tipton	97	52	75.8	6.36	
Toledo	92	46	72.4	4.43	
Vinton *[1]	92	55	72.5	4.71	
Wapello	94	56	74.8	2.59	
Washington	96	50	72.9	1.52	
Washta				7.14	
Waterloo	95	46	72.7	9.08	
Waukee				4.32	
Waverly	91	47	71.3	7.50	
Westbend	92	48	72.2	4.55	
West Union				11.12	
Whitten	93	47	72.8	4.63	
Wilton Junction	97	53	74.1	6.35	
Winterset	96	45	74.4	4.34	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Woodburn	.....	.....	.....	3.41	
Kansas.					
Achilles	99	50	73.0	4.76	
Alton	101	50	77.8	4.77	
Anthony	.....	.....	.....	1.85	
Atchison	95	55	76.8	2.67	
Baker	96	49	76.6	2.42	
Beloit	102	52	77.8	6.07	
Burlington	96	55	78.0	5.43	
Clay Center	100	52	78.0	3.31	
Colby	101	45	75.0	5.59	
Columbus	96	58	78.4	3.14	
Cottonwood	99	54	78.2	3.69	
Dresden	101	47	75.4	3.28	
Ellinwood	106	52	79.6	1.10	
Emporia	98	54	76.8	3.53	
Englewood	110	49	83.1	T.	
Eureka	.....	.....	.....	3.68	
Eureka Ranch	101	44	76.7	2.83	
Fall River	97	56	77.7	6.29	
Farnsworth	100	46	76.2	2.57	
Forsha	110	53	80.8	0.45	
Fort Leavenworth	97	57	79.3	2.22	
Fort Scott	100	58	79.4	2.96	
Frankfort	100	48	76.6	5.23	
Gove *1	100	50	75.3	1.49	
Grenola	99	55	77.5	5.36	
Hanover	101	51	78.5	3.65	
Harrison	100	48	75.6	2.97	
Hays	101	46	76.7	2.72	
Holton	.....	52	.....	3.89	
Horton	97	50	78.4	2.82	
Hoxie	102	45	76.4	3.20	
Hutchinson	108	52	78.8	3.04	
Independence	104	59	81.1	3.90	
Jetmore	108	47[j]	81.4[f]	0.10	
La Crosse	102	48	78.1	1.06	
Lakin	99	46	76.8	1.10	
Lebanon	98	50	76.0	5.60	
Lebo	97	54	80.4	2.78	
Leoti	102	44	76.8	1.70	
Macksville	108	49	78.6	0.89	
McPherson	109	53	80.0	2.96	
Madison	97	53	77.2	4.53	
Manhattan *b*	104	51	80.0	3.80	
Manhattan *c*	102	52	79.3	2.94	
Marion	104	54	81.2	3.75	
Meade	108[f]	51[f]	83.1[f]	0.56	
Medicine Lodge	109	54	81.2	1.70	
Minneapolis	101	52	77.6	2.40	
Moran	94	58	77.1	10.42	
Mounthope *1	105	60	81.2[j]	0.63	
Ness City	107	48	82.0	1.38	
Newton	108[a]	54[a]	80.6[a]	1.15	
Norwich	107	55	80.6	2.49	
Oberlin	.....	.....	.....	3.75	
Olathe	94	58	77.0	2.40	
Osage City	97	52	77.8	3.13	
Osborne	.....	.....	.....	4.78	
Oswego	97	58	78.6	3.21	
Ottawa	96	51	77.3	2.50	
Phillipsburg	.....	.....	.....	1.87	
Pittsburg	97	58	81.6	1.09	
Pleasanton	95	57	78.2	2.60	
Pratt	110	48	82.5	0.37	
Republic	98	48	75.8	6.06	
Rome	108	58	80.2	2.72	
Salina	103	49	78.7	2.94	
Sedan	101	58	80.0	3.50	
Toronto	98	54	78.2	6.98	
Ulysses	106[e]	47[e]	79.8[e]	0.35	
Valley Falls	95	52	76.2	2.82	
Viroqua	103	45	77.4	1.62	
Wakeeney	.....	.....	.....	3.80	
Wallace	102	44	75.6	5.36	
Walnut	96	60[j]	80.3[e]	3.24	
Wamego *1	98	57	77.8	3.73	
Winfield	104	54	80.0	2.19	
Yates Center	95	54	76.5	7.50	
Kentucky.					
Alpha	95	58	76.4	5.07	
Anchorage	98	51	77.0	1.48	
Bardstown	99	53	78.9	1.06	
Beattyville	.....	.....	.....	6.38	
Beaver Dam	96	53	77.5	1.18	
Berea	96	52	76.4	5.44	
Blandville	98	58	79.1	3.76	
Bowling Green	99	52	78.9	5.46	
Burnside	97	55	76.9	3.15	
Caddo	101	57	80.3	5.03	
Calhoun	97	55	77.8	3.17	
Catlettsburg	95	52	75.6	4.65	
Earlington	96	54	78.3	4.30	
Edmonton	94	54	76.0	5.63	
Eubank	92	51	74.2	5.71	
Falmouth	.....	.....	.....	2.65	
Fords Ferry	97	51	77.9	1.93	
Frankfort	95	55	76.8	3.54	
Kentucky—Cont'd.					
Franklin	93	55	78.2	2.80	
Greensburg	95	54	76.2	3.02	
Highbridge	100	53	77.9	3.23	
Hopkinsville	97	55	78.6	3.23	
Irvington	96	53	77.8	2.91	
Jackson	93	54	76.1	5.69	
Leitchfield	94	53	76.2	4.33	
Loretto	96	49	76.6	1.52	
Manchester	96	54	76.2	6.41	
Marrowbone	95[d]	54[d]	77.4[d]	6.38	
Mayfield	94	56	78.3	3.15	
Maysville	100	51	77.0	3.73	
Middlesboro	90	52	72.4	5.31	
Mount Sterling	96	52	76.3	1.43	
Owensboro	95	57	78.3	3.28	
Owenton	104	58	79.8	2.96	
Paducah *a*	.....	.....	.....	2.63	
Paducah *b*	101	62	82.4	3.14	
Richmond	99	57	79.7	2.44	
St. John	94	52	75.8	2.30	
Scott	98	53	76.8	3.89	
Shelby City	97	50	76.2	4.06	
Shelbyville	100	51	78.2	2.03	
Taylorsville	98	53	76.5	2.87	
Williamsburg	93	55	76.2	5.00	
Williamstown	95	56	75.4	4.46	
Louisiana.					
Abbeville	98	64	81.6	10.05	
Alexandria	99	61	80.7	3.98	
Amite	98	63	80.8	8.46	
Baton Rouge	95	63	80.6	6.15	
Burnside	97	62	80.6	4.54	
Calhoun	95	57	79.5	10.66	
Cameron	92	68	80.7	8.36	
Caspiana	.....	.....	.....	6.46	
Cheneyville	99	60	80.8	4.76	
Clinton	93	63	79.2	7.14	
Collinston	100	58	81.0	3.27	
Covington	100	62	82.2	8.92	
Donaldsonville	98	66	81.4	2.76	
Emilie	94	65	80.0	3.72	
Farmerville	98	57	79.1	3.93	
Franklin	99	65	82.4	2.29	
Grand Coteau	97	65	81.8	7.97	
Hammond	96	63	80.3	9.73	
Houma	96	63	80.8	7.60	
Jennings	96	66[f]	79.5[e]	7.71	
Lafayette	97	63	80.6	11.00	
Lake Charles	97	65	81.0	6.49	
Lake Providence	94	61	80.2	4.43	
Lakeside	95	69	82.0	8.51	
Lawrence	97	61	80.6	10.31	
Leesville	97	58	79.4	4.82	
Libertyhill	103	58	81.6	3.59	
Mansfield	97	54	78.4	4.20	
Melville	95	61	80.8	9.60	
Monroe	103	64	82.4	2.54	
New Iberia	92	69	81.0	5.40	
Opelousas	97	62	80.8	6.41	
Oxford	100	.....	.....	4.43	
Plain Dealing	98	61	79.5	6.62	
Port Eads	92	71	82.3	4.65	
Rayne	98	66	82.4	7.05	
Reserve	.....	.....	.....	6.46	
Robeline	98	57	79.4	3.40	
Ruston	101	56	81.5	3.44	
St. Francisville	98	61	79.2	6.10	
Schriever	96	62	81.6	9.17	
Sugar Experiment Station	95	66	81.4	5.55	
Sugartown	94	65	80.6	8.38	
Venice	95	66	79.5	6.96	
Wallace	99	64	81.6	2.46	
Maine.					
Bar Harbor	88	42	64.0	3.25	
Bemis	90	42	64.0	3.49	
Cornish	96	46	67.6	3.69	
Danforth	.....	.....	.....	4.10	
Farmington	90	43	66.4	4.27	
Fort Fairfield	86[f]	36[f]	61.2[f]	3.82	
Gardiner	91	47	68.2	4.77	
Houlton	92	40	64.3	2.78	
Lewiston	93	50	68.1	3.90	
Mayfield	85	42	64.2	5.27	
Millinocket	84	45	66.0	4.25	
North Bridgton	100	49	68.4	3.45	
Orono	88	34	62.1	6.49	
Patten	85	38	61.6	4.03	
Rumford Falls	94	48	67.0	6.01	
South Lagrange *1	87	52	65.9	.....	
The Forks	.....	.....	.....	4.58	
Vanburen	87	39	64.2	4.71	
Winslow	.....	.....	.....	4.53	
Maryland.					
Annapolis	96	.....	.....	8.00	
Bachmans Valley	92	50	72.4	6.18	
Boettcherville	99	45	74.8	5.73	
Boonsboro	95	49	73.6	5.80	
Cambridge	99	57	78.5	4.70	
Maryland—Cont'd.					
Chase	96	52	74.6	5.74	
Charlotte Hall	95[a]	42[a]	72.2[a]	3.61	
Cheltenham	98	47	76.0	4.68	
Chestertown	92	54	75.2	5.55	
Chewsville	95	49	72.8	8.85	
Clearspring	91	48	72.0	7.03	
Coleman	97	57	76.8	5.28	
Collegepark	96	49	74.6	6.55	
Colora	.....	.....	.....	3.62	
Cumberland	.....	.....	.....	3.02	
Darlington	96[a]	51[a]	74.4[a]	3.72	
Deerpark	87[f]	36[f]	65.0[f]	6.24	
Denton	98	53	75.7	3.90	
Easton	96	54	76.2	4.59	
Fallston	94	51	73.8	5.87	
Frederick	96	53	75.6	5.69	
Grantsville	90	41	67.0	4.58	
Greatfalls	100	50	76.0	4.77	
Greenspring Furnace	97	53	75.2	6.68	
Hancock	97	49	74.7	5.55	
Harney	.....	.....	.....	5.46	
Jewell	94	55	75.8	4.35	
Johns Hopkins Hospital	96	.....	.....	7.19	
Laurel	96	51	74.2	5.30	
McDonogh	93	59	74.6	8.58	
Mount St. Marys College	92	56	74.8	4.99	
New Market	93	53	73.8	7.67	
Princess Anne	93	54	75.4	5.22	
Sharpsburg	93	52	73.8	5.89	
Solomons	95	60	77.8	5.56	
Sudlersville	98	52	76.7	4.32	
Takoma Park	95	53	74.7	6.27	
Van Bibber	94	53	74.5	5.68	
Westernport	92	45	71.1	5.73	
Massachusetts.					
Amherst	97	44	69.4	4.64	
Bedford	89	50	68.8	2.87	
Bluehill (summit)	92	49	69.2	2.94	
Cambridge	94	53	71.1	3.11	
Chestnuthill	95	51	72.0	3.54	
Cohasset	.....	.....	.....	4.22	
Concord	92	46	69.0	3.27	
East Templeton *1	92	51	68.0	3.68	
Fall River	92	53	71.2	2.16	
Fitchburg *a* *1	92	54	69.2	3.05	
Fitchburg *b*	94	51	69.6	3.08	
Framingham	94	45	70.0	2.54	
Groton	92	49	68.8	4.39	
Hyannis	.....	.....	.....	2.28	
Jefferson	.....	.....	.....	3.11	
Lawrence	96	51	70.1	2.95	
Leominster	.....	.....	.....	3.47	
Lowell *a*	96	52	72.0	2.62	
Lowell *b*	95	51	70.8	.....	
Ludlow Center	.....	.....	.....	5.12	
Middleboro	93	44	69.2	2.33	
Monson	90	43	68.6	2.44	
New Bedford	91	51	69.8	2.22	
Plymouth *1	90	56	70.0	2.36	
Princeton	.....	.....	.....	3.95	
Provincetown	90	54	68.8	2.48	
Salem	.....	.....	.....	2.27	
Somerset *1	99	51	73.8	3.28	
Sterling	.....	.....	.....	3.27	
Taunton	93	44	69.0	3.89	
Webster	.....	.....	.....	2.98	
Westboro	95	50	71.2	2.36	
Weston	91	45	68.7	4.35	
Williamstown	87	43	67.2	3.49	
Winchendon	.....	.....	.....	6.05	
Worcester	96	52	70.8	3.01	
Michigan.					
Adrian	94	47	72.4	6.19	
Agricultural College	92	43[k]	67.9[f]	3.79	
Allegan	94[d]	40[d]	69.8[d]	5.66	
Alma	92	44	69.8	2.73	
Ann Arbor	92	45	71.4	4.65	
Annpere	88	.....	.....	2.50	
Arbela	93	43	70.2	4.45	
Ball Mountain	89	45	69.0	4.28	
Baraga	94	20	62.1	.....	
Battlecreek	93	50	71.5	3.18	
Bay City	95	40	70.7	0.60	
Benzonia	87[h]	46[i]	67.6[h]	2.02	
Berlin	91	45	70.2	4.62	
Berrien Springs	94	47	71.4	7.02	
Big Rapids	91	40	68.0	1.59	
Birmingham [b]	93	48	69.2	2.17	
Boon	88	39	64.3	2.73	
Calumet	90	47	63.0	2.89	
Cassopolis	94	48	72.9	5.00	
Charlevoix	90	52	69.8	2.35	
Chatham	92	38	64.2	6.64	
Cheboygan	90	45	66.6	2.10	
Clinton	95	45	72.4	3.54	
Coldwater	95	47	72.0	6.53	
Deerpark	88	45	61.6	4.49	
Detour	88	48	64.2	5.36	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dundee	92	46	71.4	4.50	
Eagle Harbor	94	44	69.7	2.51	
East Tawas	87	43	66.9	4.53	
Eloise	94	45	72.0	3.93	
Ewen	86	31	63.0	5.46	
Fennville	93	45	69.0	5.54	
Fitchburg	91	43	69.6	4.25	
Flint	92	44	69.8	1.09	
Frankfort	84	44	64.7	.....	
Gaylord	90	38	62.5	4.10	
Gladwin	92	43	68.4	2.80	
Grand Haven	85[a]	49	67.8[a]	2.08	
Grand Marais	84	46	61.6	4.72	
Grape	95	45	72.0	3.41	
Grayling	92	41	68.0	3.54	
Hagar	96	46	70.6	7.50	
Harbor Beach	92	46	69.4	2.81	
Harrison	87	44	63.4	1.23	
Harrisville	94	46	66.1	5.52	
Hart	92	.....	.....	1.05	
Hastings	94	42	70.3	5.68	
Hayes	91[c]	48[b]	68.9[b]	2.99	
Highland Station	.....	.....	.....	3.61	
Hillsdale	92	43	69.8	6.77	
Humboldt	91	34	61.5	.....	
Ionia	95	44	70.8	.....	
Iron Mountain	89	41	66.3	5.42	
Iron River	88	35	63.8	9.50	
Ironwood	88	41	64.6	7.33	
Ishpeming	88	41	64.2	6.53	
Ivan	88	42	65.8	3.72	
Jackson	97	47	73.7	4.65	
Jeddo	92	45	69.8	2.83	
Kalamazoo	93[f]	47[f]	71.7[f]	3.72	
Lake City	.....	.....	.....	0.17	
Lansing	92	45	70.5	4.79	
Lapeer	92[d]	45[d]	69.3[d]	4.09	
Lincoln	92	45	70.8	.....	
Ludington	88[b]	45	68.8[f]	1.30	
Mackinac Island	80	40	63.8	4.01	
Mackinaw	87	48	66.4	5.75	
Mancelona	90	44[e]	68.0[e]	0.40	
Manistique	82	45	63.7	5.01	
Marine City	91	46	69.8	4.72	
Menominee	89	44	67.4	1.34	
Midland[b]	98	45	71.6	.....	
Mio	90	40	65.2	4.44	
Montague	88	46	67.5	1.43	
Mount Pleasant	92	55[d]	74.5	1.26	
Muskegon	85	48	68.6	3.40	
Newberry	95	44	68.2	6.95	
Old Mission	90	52	69.2	2.71	
Olivet	91	47	71.1	5.00	
Omer	92	31	66.1	1.09	
Onaway	90	42	66.4	4.83	
Ontonagon	94	47	63.3	3.73	
Ovid	93	43	69.8	3.92	
Owosso	99	46	73.6	1.70	
Petoskey	93	50	67.8	3.57	
Port Austin	91	49	69.2	2.62	
Roscommon	94	38	67.2	2.74	
Saginaw (W. S.)	94	46	71.6	2.81	
St. Johns	94	47	71.4	.....	
St. Joseph	92	.....	.....	4.45	
Slocum	88	55[m]	68.2[f]	.....	
Somerset	.....	44[e]	.....	3.00	
South Haven	85	46	67.2	5.28	
Thomaston	85	33	63.0	6.08	
Thornville	90	49	70.0	3.17	
Traverse City	94	46	69.2	2.39	
Vassar	91	45	71.9	1.12	
Wasepi	90	45	69.4	6.97	
Waverly	91	43	68.8	6.22	
Webberville	93	43	69.4	4.56	
West Branch	92	42	68.7	2.18	
Wetmore	84	20	53.4	2.82	
Whitefish Point	86	43	58.7	4.35	
Ypsilanti	91	44	69.4	4.29	
Minnesota.					
Albert Lea	88	42	69.6	3.21	
Alexandria	89	45	66.4	7.18	
Angus	93	35	65.2	0.87	
Ashby	89	41	66.3	5.52	
Beardsley	90	37	67.0	8.29	
Beaulieu	89[d]	34[d]	65.8[d]	1.31	
Bemidji	92	41	68.1	4.48	
Bird Island	90	.....	.....	5.90	
Blooming Prairie	86	43	68.5	3.80	
Caledonia	90	45	69.2	9.83	
Campbell	90	39	66.3	4.71	
Collegeville	89	49	68.8	8.85	
Crookston	92	41	66.4	1.79	
Currie	89	43	68.6	5.86	
Deephaven	.....	.....	.....	5.92	
Detroit	90	37	64.9	5.69	
Duluth (sub station)	89	44	61.9	4.12	
Faribault	88	41	67.8	8.26	
Farmington	90	43	68.4	3.09	
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fergus Falls	92	41	67.3	5.17	
Floodwood	91	39	64.1	4.47	
Glencoe	90	42	68.6	4.45	
Grand Meadow	89	44	69.8	5.04	
Hallock	92	35	65.3	2.20	
Lake Winnibigoshish	87	40	65.0	1.14	
Leech	91	26	64.0	2.94	
Long Prairie	92	37	66.6	6.08	
Luverne	89	57	67.8	6.31	
Lynd	88	40	67.0	4.86	
Mapleplain	90	44	68.2	4.50	
Milaca	90[c]	42[b]	66.3[d]	11.41	
Milan	89	43	66.7	6.50	
Minneapolis[1]	92[b]	44	69.1	7.37	
Montevideo	92	41	67.3	6.60	
Morris	90	46	66.2	5.63	
Mount Iron	93	35	63.0	3.21	
New London	92	46	68.5	6.24	
New Richland	90	45	71.0	1.63	
New Ulm	96	45	71.8	5.58	
Park Rapids	90	40	64.8	2.38	
Pine River	90	40	65.6	5.60	
Pipestone	86	44	67.2	5.77	
Pleasant Mounds	88	48	68.6	5.75	
Pokegama Falls	91	33	63.6	2.67	
Redwing *a*	.....	.....	.....	3.38	
Redwing *b*	90	46	70.9	4.24	
Reeds	.....	.....	.....	3.70	
Rolling Green	87	49	70.2	8.06	
St. Cloud	91	46	67.8	10.53	
St. Peter	91	43	68.4	4.17	
Sandy Lake Dam	90	43	65.0	6.38	
Shakopee	90	45	69.0	3.49	
Thief River Falls	90	38	65.4	1.49	
Tower	95	30	60.1	3.20	
Two Harbors	88	40	61.4	5.09	
Wabasha	93	44	71.9	4.45	
Warroad	90	32	66.8	.....	
Willow River	91	37	65.8	5.75	
Winnebago	90	47	70.2	6.69	
Winona	89	47	70.5	3.76	
Worthington	88	50	68.8	9.19	
Wyoming	.....	.....	.....	7.27	
Zumbrota	90	40	69.2	4.53	
Mississippi.					
Aberdeen	103	59	82.8	2.09	
Agricultural College	96	.....	.....	4.80	
Austin	95	59	79.0	3.30	
Batesville	97	58	81.1	3.30	
Biloxi	98	65	81.7	8.97	
Boggan	100	58	80.8	4.82	
Booneville	99	57	79.8	1.09	
Brookhaven	99	61	80.8	6.55	
Canton	99	58	80.6	2.25	
Columbia	98	60	80.0	9.52	
Columbus	96	61	81.0	2.99	
Corinth	92	58	78.3	5.27	
Crystal Springs	97	62	80.4	5.64	
Duck Hill	98	55	80.2	3.15	
Edwards	98	59	81.0	4.39	
Fayette	97	55	77.6	8.15	
Fayette (near)	.....	.....	.....	7.23	
Greenville *a*	93	64	80.8	4.59	
Greenville *b*	100	62	82.6	4.71	
Greenwood	99	56	80.9	3.10	
Hattiesburg	102	61	82.3	4.97	
Hazlehurst	100	62	81.0	7.70	
Hernando	99	62	81.0	7.45	
Holly Springs	95	63	81.2	3.99	
Indianola	97	58	81.0	3.02	
Jackson	98	59	80.6	2.71	
Kosciusko	96	59	80.4	3.66	
Lake	98	59	80.1	2.02	
Lake Como	98	59	81.0	5.47	
Laurel[a]	102	64	82.8	4.98	
Leakesville	101	59	81.2	5.68	
Louisville	98	59[e]	79.8	2.66	
McNeill	98	62	80.4	11.05	
Macon	102	63	83.6	1.80	
Magnolia	97	59	80.0	6.28	
Natchez	95	62	80.5	6.40	
Nittayuma	100	57	81.5	2.99	
Okolona	103	61	83.4	1.32	
Patmos	.....	.....	.....	3.71	
Pearlington	100	61	80.8	9.76	
Pittsboro	98	57	80.3	2.43	
Pontotoc	94	59	79.8	4.23	
Port Gibson	97	58	80.6	3.98	
Poplarville	.....	64	.....	7.25	
Ripley	93	56	78.2	6.85	
Shoccoe	99	58	80.7	4.60	
Stonington	.....	.....	.....	7.87	
Suffolk	94	59	78.8	9.53	
Swartwout	99	67	81.2	7.20	
Tupelo	98	56	80.6	0.58	
University	96	59	80.5	2.52	
Walnutgrove	.....	59	.....	3.03	
Watervalley	97	56	81.6	2.97	
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Waynesboro	98	60	79.8	4.16	
Westpoint	99	60	82.5	1.64	
Woodville	95	62	80.0	7.41	
Yazoo City	99	51	82.0	1.75	
Missouri.					
Arthur	96	56	77.6	2.96	
Avalon	100	55	79.0	1.83	
Bethany	97	53	75.4	3.29	
Birchtree	92	61	76.8	6.52	
Blue Springs	95	57	76.6	2.78	
Boonville	.....	.....	.....	2.71	
Brunswick	97	59	77.7	2.41	
Carrollton	96	57	77.5	4.01	
Caruthersville	99	60	80.8	3.16	
Conception	96	51	76.0	1.42	
Cowgill	.....	.....	.....	2.14	
Darksville	94	57	76.2	2.85	
Dean	97	52	77.2	1.18	
Desoto	99	57	77.6	3.70	
Downing	.....	.....	.....	2.18	
Edgehill	95	53	76.2	3.23	
Edwards	96	54	77.0	4.21	
Eightmile[g]	.....	63	78.4	2.67	
Fairport	.....	.....	.....	1.39	
Fayette	95	57	78.2	2.61	
Fulton	98	56	77.4	4.45	
Gallatin[g]	100	64	78.8	6.13	
Glasgow	96	58	78.0	2.32	
Gorin	.....	.....	.....	1.23	
Grant City	93	52	74.9	5.30	
Halfway	93	57	76.8	3.16	
Harrisonville	98	57	78.1	2.45	
Hazlehurst	.....	.....	.....	3.09	
Hermann	.....	.....	.....	2.84	
Houston	99	58	77.9	6.33	
Huntsville	96	57	77.2	2.57	
Ironton	98	54	78.6	4.63	
Jackson	97	54	78.4	2.31	
Jefferson City	98	60	78.2	2.26	
Joplin	93	57	78.8	4.09	
Kidder	98	54	76.5	2.31	
Koshkonong	95	62	77.4	4.35	
Lamar	97	56	79.0	1.86	
Lamonte	.....	.....	.....	6.22	
Lebanon	95	59	77.2	5.33	
Lexington	97	59	77.6	3.18	
Liberty	96	58	76.8	3.37	
Louisiana	98	52	77.0	2.47	
Macon	98	57	77.1	3.25	
Marblehill	100	58	79.5	2.74	
Marshall	98	56	76.6	4.91	
Maryville	96	51	75.8	2.52	
Mexico	98	55	77.6	2.73	
Miami[d,b]	97	65	80.1	4.09	
Mineralspring	94	58	77.2	1.55	
Monroe City	96	53	75.8	2.43	
Montreal	95	53	75.4	7.00	
Mountaingrove	94	54	76.2	3.47	
Mount Vernon	96	52	76.6	2.07	
Neosho	96	54	77.6	3.17	
Nevada	.....	.....	.....	3.17	
New Haven	99	60	79.4	2.48	
New Madrid *b*	.....	.....	.....	2.84	
New Palestine	99	58	77.6	2.67	
Oakfield	97	58	78.5	4.11	
Olden	97	57	77.4	2.68	
Oregon	93	52	75.6	4.11	
Palmyra	96	60	77.6	1.25	
Pine Hill	.....	.....	.....	3.25	
Princeton	102	55	77.4	2.97	
Protem	100	61	79.0	2.67	
Richmond	.....	.....	.....	3.00	
Rockport	.....	.....	.....	4.34	
Rolla	.....	.....	.....	0.78	
St. Charles	96	57	78.4	2.67	
St. Joseph	.....	.....	.....	1.40	
Sarcoxie	.....	.....	.....	2.91	
Sedalia	94	57[e]	77.0[e]	5.03	
Seymour	92	56	74.8	3.95	
Shelbina	.....	.....	.....	3.88	
Sikeston	96	57	78.2	4.58	
Steffenville	96	58	76.2	2.28	
Sublett	97	55	75.8	2.47	
Trenton	96	59	76.8	2.20	
Unionville	98	56	77.8	3.03	
Warrensburg	96	60	77.8	6.78	
Warrenton	99	57	79.0	2.19	
Wheatland	.....	.....	.....	3.92	
Willowsprings	95	57	75.8	8.56	
Windsor	94[d]	55[e]	76.2[e]	4.64	
Zeitonia	99	57	78.9	2.51	
Montana.					
Adel	85	31	56.6	3.32	
Augusta	93	34	60.0	3.54	
Billings	96	38	66.0	.....	
Boulder	86	36	60.6	1.91	
Bozeman	85	33	59.4	2.76	
Butte	84	33	60.2	0.65	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Canyon Ferry	91	40	64.6	4.41	
Chinook	98	42	66.9	2.78	
Columbia Falls	93	32	59.8	2.83	
Crow Agency	100	47	69.4	3.11	
Culbertson	96	37	65.0	2.74	
Dayton	92	37	60.6	2.66	
Deerlodge	85	35	59.8	.....	
Dillon	85	34	59.3	2.49	
Fort Benton	93	43	64.8	3.70	
Fort Harrison	94	39	64.0	.....	
Glasgow	100	44	67.2	1.37	
Glendive	102	40	67.1	3.55	
Greatfalls	92	42	65.6	2.74	
Hamilton	94	38	62.0	0.87	
Hayden	98	37	62.0	3.25	
Lamedeer	101	40	69.3	2.79	
Lewistown	94	35	60.6	5.60	
Manhattan	89	35	63.3	2.78	
Marysville	87[f]	33[f]	58.6[f]	2.75	
Ovando	92	31	58.0	1.87	
Parrot	89	38	62.8	1.34	
Plains	94	38	62.5	1.42	
Poplar	99	42	68.6	2.62	
Redlodge	86	34	59.8	1.81	
Ridgelawn	98	41	67.2	3.88	
St. Pauls	93	41	63.4	5.18	
St. Peter	85	31	57.8	5.89	T.
Summit	84	32	54.9	.....	
Toston	87	34	60.2	1.24	
Townsend	.....	.....	.....	1.52	
Troy	97	33	60.0	1.61	
Twodot	93	35	60.5	1.36	
Utica	93	39	62.2	2.57	
Wolf Creek	93	35	60.6	2.99	
Wolsey	88	28	54.4	4.35	
Yale	95	37	62.4	2.16	
Nebraska.					
Agate	96	42	68.1	1.93	
Agee[*1]	100	52	71.1	4.82	
Albion	91	52	71.7	5.61	
Alliance	.....	.....	.....	4.45	
Alma	102	46	76.0	5.52	
Ansley	99	42	73.0	6.45	
Arapahoe	.....	.....	.....	4.76	
Arcadia	94	50	72.8	8.05	
Ashland *a*	98	52	76.8	5.92	
Ashland *b*	.....	.....	.....	7.27	
Ashton	.....	.....	.....	8.18	
Auburn	100	46	77.6	1.01	
Aurora	100	51	77.8	4.90	
Bartley	100	45	74.9	4.99	
Beatrice	101	48	76.4	1.79	
Beaver	103	47	74.8	6.29	
Bellevue	.....	.....	.....	4.17	
Benedict	.....	.....	.....	9.21	
Benkleman	.....	.....	.....	1.96	
Blair	99	47	74.0	6.27	
Bluehill	.....	.....	.....	5.73	
Bradshaw	.....	.....	.....	5.77	
Bridgeport	98	47	71.8	1.93	
Brokenbow	97	45	71.6	6.27	
Burchard	.....	.....	.....	1.55	
Burwell	.....	.....	.....	7.36	
Callaway	95	51	73.0	7.70	
Cedar Rapids	95	53	71.4	8.27	
Central City	.....	.....	.....	8.88	
Chester	.....	.....	.....	5.10	
Cody	.....	.....	.....	4.14	
Columbus	96	53	74.2	6.28	
Crete	97	50	76.0	2.45	
Culbertson	101	42	72.6	4.05	
David City	98	52	73.9	5.82	
Dawson	98	50	77.1	2.09	
Edgar	.....	.....	.....	5.75	
Ericson	.....	.....	.....	8.00	
Ewing	.....	.....	.....	7.08	
Fairbury	101	48	75.0	4.38	
Fairmont	98	50	74.1	2.00	
Fort Robinson	94	45	69.4	4.70	
Fremont	100	49	74.2	4.87	
Geneva	99	48	75.1	3.75	
Genoa (near)	94	52	74.0	9.90	
Gering	96	46	71.8	1.48	
Gordon	.....	.....	.....	2.30	
Gosper	.....	.....	.....	7.31	
Gothenburg	99	45	72.5	6.59	
Grand Island *a*	.....	.....	.....	9.39	
Grand Island *b*	98	49	75.2	9.31	
Greeley	.....	.....	.....	6.70	
Guide Rock	.....	.....	.....	6.89	
Halsey	100	46	72.8	5.24	
Hartington	94	48	70.6	4.25	
Harvard	96	50	73.4	7.30	
Hastings[*1]	96	54	76.2	5.06	
Hayes Center	.....	.....	.....	4.15	
Hay Spring	95	44	67.9	8.92	
Hebron	99	51	75.8	2.87	
Hickman	.....	.....	.....	3.55	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Holbrook	.....	.....	.....	8.71	
Holdrege	.....	.....	.....	7.15	
Hooper[*1]	100	54	75.0	5.39	
Imperial	100	42	74.3	4.87	
Johnstown	.....	.....	.....	4.72	
Kearney	94	46	72.3	8.40	
Kennedy	97	49	70.8	5.38	
Kimball	95	41	70.1	3.66	
Kirkwood	95	52	71.9	9.15	
Leavitt	102	50	75.4	6.57	
Lexington	95	46	72.3	9.24	
Lockridge	101	51	74.9	4.56	
Lodgepole	95	43	70.6	2.90	
Loup	96	45	72.4	9.24	
Lynch	97	47	73.3	7.31	
Lyons	.....	.....	.....	5.55	
McCook	.....	.....	.....	6.39	
McCool Junction	.....	.....	.....	5.00	
Madison	96	50	71.3	4.41	
Madrid	100	42	71.6	4.06	
Marquette	.....	.....	.....	6.44	
Mason	.....	.....	.....	5.94	
Minden	94	47	72.6	8.26	
Monroe	.....	.....	.....	8.22	
Nebraska City *c*	99	.....	.....	1.49	
Nemaha	.....	.....	.....	2.95	
Norfolk	95	50	72.8	6.35	
North Loup	94	43	70.2	6.46	
Oakdale	95	51	72.4	8.12	
O'Neill	98	51	71.5	5.04	
Ord	.....	.....	.....	8.19	
Osceola	.....	.....	.....	9.55	
Palmer	.....	.....	.....	7.53	
Palmyra[*1]	96	56	75.3	3.62	
Pawnee City	.....	.....	.....	2.14	
Plattsmouth *a*	.....	.....	.....	3.97	
Plattsmouth *b*	102	51	77.4	3.35	
Purdum	98	50	71.6	6.52	
Ravenna *a*	94	46	72.8	9.58	
Ravenna *b*	.....	.....	.....	8.91	
Redcloud	100	50	75.0	2.80	
Republican	.....	.....	.....	6.00	
Rulo	.....	.....	.....	1.45	
St. Libory	.....	.....	.....	8.13	
St. Paul	97	48	75.0	6.85	
Santee	96	50	73.5	5.26	
Schuyler	.....	.....	.....	4.17	
Seward	100	55	77.4	7.23	
Smithfield	.....	.....	.....	8.21	
Spragg	.....	.....	.....	6.10	
Springview	98	50	71.3	6.33	
Stanton	92	50	72.6	5.46	
Stromsburg	.....	.....	.....	9.97	
Strang	.....	.....	.....	5.71	
Stratton	.....	.....	.....	2.26	
Superior	102	53	77.6	7.56	
Syracuse	.....	.....	.....	2.12	
Tablerock	.....	.....	.....	1.80	
Tecumseh *c*	.....	.....	.....	1.30	
Tekamah	101	49	75.0	7.31	
Turlington	99	48	75.5	1.83	
University Farm	100	48	76.0	2.48	
Wahoo	.....	.....	.....	5.03	
Wakefield	95	45	72.2	3.02	
Wallace	.....	.....	.....	3.76	
Wauneta	.....	.....	.....	2.74	
Weeping Water	.....	.....	.....	3.12	
Westpoint	98	50	74.6	4.48	
Whitman	.....	.....	.....	1.25	
Wilber[*1]	100	56	77.4	2.58	
Willard	.....	.....	.....	1.94	
Wilsonville	.....	.....	.....	2.15	
Winnebago	94	43	71.6	4.66	
Wisner	.....	.....	.....	5.90	
Wymore	99	58	78.8	4.90	
Nevada.					
Austin	87	37	65.4	0.00	
Battle Mountain	100	32	69.7	0.00	
Belmont	87	35	65.8	0.00	
Beowawe[*1]	99	42	70.7	0.00	
Caliente	104	42	73.6	0.01	
Candelaria	91	47	71.5	0.00	
Carlin[*1]	99	40	72.8	0.00	
Carson City	99	33	63.0	0.00	
Cranes Ranch	.....	.....	.....	0.00	
Dyer	96	35	66.0	0.00	
Elko	98	31	65.6	0.00	
Ely	92	35	65.6	T.	
Eureka	93	33	67.0	0.00	
Fallon	92	38	67.6	0.00	
Golconda[*1]	96	55	74.9	0.00	
Halleck[*1]	96	46	72.5	T.	
Hawthorne	95	45	71.4	0.00	
Humboldt	93	36	68.0	0.00	
Lee	.....	.....	.....	0.01	
Lewers Ranch	87	35	62.7	0.00	
Lovelocks	.....	.....	.....	0.00	
Martins	91	33	66.2	0.00	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nevada—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mill City[*1]	96	60	75.2	0.00	
Morey	102	36	70.2	T.	
Palisade	.....	.....	.....	0.00	
Palmetto	92	32	63.0	0.00	
Potts	100	26	63.4	0.00	
Reno State University	90	36	65.0	0.00	
Rioville	111	60	87.2	0.16	
Silverpeak	99	51	75.5	0.00	
Sodaville	102	42	76.1	0.00	
Tecoma	98	32	69.4	0.00	
Toano[*b]	107	42	78.4	0.00	
Wabuska	100	32	65.8	0.00	
Wadsworth	94	40	68.8	0.00	
Wells	94	45	70.2	0.00	
Wood	91	31	63.4	0.04	
New Hampshire.					
Alstead	92	43	67.2	2.76	
Berlin Mills	92	40	64.7	3.44	
Brookline[*1]	96	49	70.6	3.71	
Chatham	93	42	65.0	4.25	
Concord	93	47	67.8	5.36	
Durham	92	50	68.9	4.92	
Franklin Falls	90	49	66.6	3.33	
Grafton	92	38	65.5	3.92	
Hanover	95	42	66.8	4.64	
Keene	94	39	68.0	2.09	
Littleton	87	41	64.8	4.30	
Nashua	96	49	70.4	2.90	
Newton	92	45	68.0	2.87	
Plymouth	96	45	68.0	4.44	
Sanbornton	92	46	66.0	3.03	
Stratford	95	39	65.2	3.27	
New Jersey.					
Asbury Park	97	53	73.8	6.22	
Barnegat	93	50	71.2	6.17	
Bayonne	95	52	74.0	3.47	
Belvidere	95	47	72.6	4.63	
Bergen Point	95	53	73.2	4.10	
Beverly	96	50	74.6	7.49	
Blairstown	97	44	72.0	3.93	
Bridgeton	100	50	76.6	6.54	
Camden	97	56	76.0	4.68	
Canton	.....	.....	.....	6.23	
Cape May C. H	97	50	74.8	8.60	
Charlotteburg	96	38	69.9	3.79	
Chester	92	46	69.8	7.59	
Clayton	94	50	73.3	6.71	
College Farm	95	48	73.3	5.07	
Dover	96[f]	43[f]	70.8[f]	5.47	
Elizabeth	98	49	74.6	4.31	
Englewood	95	55	74.1	4.05	
Flemington	99	48	73.8	5.78	
Friesburg	98	47	74.3	5.64	
Hanover	93	45	70.5	5.40	
Hightstown	94	50	73.4	5.23	
Imlaystown	95	50	74.6	6.72	
Indian Mills	98	46	75.0	4.15	
Lakewood	93	49	72.4	7.36	
Lambertville	96	48	74.2	6.05	
Layton	94	39	68.8	4.67	
Moorestown	94	50	73.4	5.44	
Newark	95	51	73.6	4.27	
New Brunswick	96	50	74.3	5.63	
Newton	97	44	71.4	3.43	
Oceanic	95	55	73.2	5.13	
Paterson	96	51	74.8	5.40	
Pemberton	96	47	74.2	4.26	
Perth Amboy	96	57	75.8	3.60	
Phillipsburg	96	48	73.4	6.89	
Plainfield	96	47	73.7	4.70	
Pleasantville	.....	.....	.....	8.27	
Rancocas	.....	.....	.....	5.56	
Ringwood	95[d]	42[d]	70.2[d]	3.08	
Rivervale	96	42	70.7	3.41	
Salem	99	52	76.0	6.74	
Somerville	97	45	72.8	5.80	
South Orange	93	49	72.6	4.22	
Sussex	93	44	70.6	3.37	
Toms River	97	44	73.4	6.98	
Trenton	94	55	75.8	4.52	
Tuckerton	98	45	74.2	7.17	
Vineland	98	49	74.4	5.46	
Woodbine	96	47	73.6	8.15	
Woodstown	.....	.....	.....	6.32	
New Mexico.					
Alamagordo	109	60	84.0	0.83	
Albert	101	50	78.2	1.90	
Albuquerque	98	44	75.2	0.32	
Alma	102	43[e]	75.2	1.46	
Arabela	97	51	75.6	0.72	
Bellranch	.....	.....	.....	0.73	
Cambray	.....	.....	.....	0.09	
Carlsbad	105	58	83.0	0.00	
Deming	.....	.....	.....	0.01	
Dorsey	92	39	68.7	0.95	
Eagle Rock Ranch	90	36	69.6	1.10	
Engle	98	54	77.6	T.	
Fort Bayard	97	52	75.6	0.45	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Mexico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Stanton	93	49	70.6	0.62	
Fort Union	95	33	67.4	0.78	
Fort Wingate	89	41	68.9	1.18	
Fruitland	99	34	74.5	0.09	
Galisteo	92	50	73.4	1.93	
Gallinas Springs	101	48	76.8	0.01	
Golden				0.81	
Las Vegas	96	40	70.5	1.41	
Lordsburg				0.45	
Luna	95	34	68.2	1.31	
Mesilla Park	101	52	80.2	0.97	
Mountainair	94	41	70.1	0.52	
Raton	95	42	72.0	0.02	
San Marcial	108	57	82.0		
Strauss				0.15	
Taos	95	34	70.0	0.37	
Winsors	83	26	58.0	3.75	
New York.					
Adams				7.19	
Addison	94	42	69.1	5.51	
Akron				5.38	
Alden	90	46	67.4	3.00	
Amsterdam		44[j]	65.6[j]		
Angelica	91	41	66.4	4.11	
Appleton	91	46	69.4	3.68	
Athens	93	48	70.8	4.16	
Atlanta	92	39	66.6	4.27	
Auburn	93	47	69.6	4.19	
Avon	91	41	68.0	2.19	
Axton	92	31	61.1	7.78	
Baldwinsville	90	46	69.4	4.17	
Beaver	90	32	62.2	3.91	
Bedford	97	45	73.4	1.85	
Berlin	90	45	66.5	3.72	
Blue Mountain Lake				4.92	
Bolivar [e]	92	35	66.0	4.62	
Bouckville	89	41	66.1	2.49	
Boyds Corner				3.54	
Brockport	94	45	70.8	4.68	
Brown Station				3.47	
Caldwell	89	45	67.6	3.86	
Canajoharie	88	43	66.7	6.06	
Canaan Four Corners	87	42	66.6	8.15	
Carmel	93	47	70.9	2.44	
Carvers Falls	90	44	66.4	5.22	
Chazy	92	45	68.0	5.13	
Clockville				3.19	
Cooperstown	86	42	65.4	5.52	
Cortland	94	41	69.0	3.99	
Cutchogue	94	50	71.4	1.89	
Dekalb Junction	90	43	67.2	5.45	
De Ruyter	88	39	64.1	4.13	
Easton				3.35	
Elba	85	47	66.6	4.06	
Elmira	96	42	71.3	4.78	
Fayetteville	93	46	69.0	3.35	
Franklinville	89	39	66.0	4.65	
Gabriels	89	32	60.2	4.92	
Gansevoort				3.91	
Glens Falls	91	45	68.4	3.09	
Gloversville	92	42	67.6	4.06	
Greenwich	88	43	68.0	2.57	
Griffin Corners	86	34	63.1	3.11	
Harkness	92	45	67.1	5.49	
Haskinville				2.96	
Hemlock	89	51	69.8	4.19	
Homer	91[f]		66.2[f]		
Honeymead Brook	91	45	69.4	3.82	
Indian Lake	89	34	62.5	4.68	
Ithaca	92	42	67.4	2.64	
Jamestown	94	42	69.1	5.94	
Jeffersonville	92	38	66.7	4.19	
Keene Valley	93	37	65.3	5.33	
King Ferry				3.97	
Liberty	87[e]	42[e]	65.6[e]	4.36	
Littlefalls, City Res.	88	46	65.9	5.16	
Lockport	90	49	69.7	3.77	
Lowville	89	40	65.2	7.25	
Lyndonville				3.90	
Lyons	94	46	71.8	4.55	
Middletown	94	53	72.0	4.04	
Mohonk Lake	88	51	68.6	4.02	
Moira	89	43	66.8	5.57	
Mount Etrick	87	46	66.2	3.79	
Newark Valley				4.44	
New Lisbon	89	35	63.2	5.24	
North Lake				2.44	
Number Four	82	38	62.8	10.03	
Nunda	94[e]	43[e]	69.2[e]	3.14	
Ogdensburg	88	45	68.6	6.61	
Old Chatham				2.67	
Oneonta	94	41	67.4	4.81	
Oswegatchie [f]	90	40	65.3		
Otto	89	46	68.6	4.22	
Oxford	89	41	66.2	3.98	
Oyster Bay	98	49	73.0	3.23	
Palermo				3.51	
Penn Yan	95	50	70.4	5.76	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Perry City	92	38	66.7	4.94	
Plattsburg	91	40	67.2	4.40	
Port Jervis	94	45	70.5	4.50	
Potsdam	89	43	67.7	5.91	
Primrose	98	45	71.8	3.48	
Redhook				4.08	
Richmondville	89	42	66.7	3.12	
Ridgeway	91[e]	51[e]	69.6[e]	4.41	
Rome	90	46	69.5	6.20	
Romulus [m]	94	49	71.3		
Salisbury Mills				2.28	
Saranac Lake	89	39	63.9	5.31	
Saratoga Springs	93	45	68.6	4.20	
Scottsville				3.63	
Setauket	92	56	72.0	2.26	
Shokan				3.70	
Shortsville	89	49	69.0	2.59	
Skaneateles				4.55	
Southampton	91	49	70.6	1.66	
South Butler	90	45	67.7	3.03	
South Canisteo	89	40	66.4	4.59	
Southeast Reservoir				2.45	
South Kortright	90	35	64.8	3.39	
South Schroon	90	45	65.4	5.74	
Speer Falls	95	46	69.0	3.61	
Straits Corners	94[e]	36[e]	65.6[e]	5.24	
Ticonderoga	92	46	69.4	5.75	
Volusia	85	49	66.7	4.50	
Walton	90	37	65.7	3.45	
Wappinger Falls	93	46	70.4	6.25	
Warwick				3.23	
Watertown	87	45	68.4	5.52	
Waverly	95	38	69.0	3.87	
Wedgwood	90	47	66.9	3.26	
Wells	93	36	65.1	4.25	
West Berne	88	37	65.2	2.91	
Westfield *b*	88	51	68.6	5.85	
Windham	90	40	65.8	2.37	
Youngstown				2.70	
North Carolina.					
Bryson City				3.54	
Currituck				4.95	
Edenton	96	56	80.6	5.97	
Fayetteville	90	60	79.2	3.21	
Flatrock	91	47	72.5	2.90	
Goldsboro	95	61	80.2	3.59	
Graham				5.11	
Greensboro	95	58	77.8	1.89	
Henderson	97	58	78.9	2.82	
Hendersonville	91	51	73.4	6.50	
Henrietta	98[b]	56[b]	79.0[b]	0.21	
Horse Cove	86	52	71.6	2.80	
Jefferson	89	43	69.5	3.74	
Kinston	97[j]	60[j]	79.4[j]	8.07	
Lenoir	93	51	75.4	4.16	
Littleton	99	58	78.6	3.99	
Louisburg	97	60	79.6	1.75	
Lumberton	96	65	81.4	6.25	
Marion	96	52	76.4	1.74	
Mocksville	97	59[j]	77.9[d]	2.96	
Moncure	102	54	79.0	2.19	
Monroe	99	54	79.0	1.71	
Morganton	95	51	76.3	2.27	
Mountairy [f]	94	49	75.2	3.40	
Murphy				4.23	
Nantahala Park [j]	82	41	65.3	2.39	
Newbern	94	63	79.6	5.18	
Penelo	97	60	80.0	3.01	
Pittsboro	99	55	79.7	2.45	
Reidsville	95	54	77.6	3.41	
Rockingham	100	63	80.6	6.75	
Roxboro	96	55	78.2	2.97	
Salisbury	100	57	81.0	1.70	
Saxon	97	59	75.9	3.12	
Selma	101	59	81.1	2.64	
Settle	100	58	80.0	3.64	
Sloan	95	61	78.8	8.74	
Soapstone Mount	95	53	77.2	6.12	
Southern Pines *a*	98	59	80.0	2.62	
Southern Pines *b*	98	61	80.1	3.18	
Southport	94	65	81.6	1.43	
Springhope	95	61	80.2	5.68	
Statesville	95	51	76.8	3.55	
Tarboro	99	61	81.6	4.44	
Washington	101	65	84.2	5.84	
Waynesville	87	46	70.2	3.05	
Weldon *a*	99	59	80.2	3.33	
Weldon *b*				3.46	
Whiteville	96	59	79.7	8.99	
North Dakota.					
Amenia	90	36	66.5	3.07	
Ashley	100	29	66.4	2.84	
Berlin	100	30	65.2	2.39	
Churchs Ferry	95	37	65.6	1.35	
Coldharbor	94	38	66.3	2.75	
Devils Lake	95	38	67.0	1.58	
Dickinson	98	38	69.6	0.52	
Donnybrook				2.83	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dunseith	96	38	63.5	1.44	
Edgeley	101	33	67.2	1.93	
Elbowoods	95	36	64.8	2.29	
Ellendale	101	36	67.4	3.91	
Fargo	95	37	65.8	2.62	
Forman	92	39	67.0	5.72	
Fort Yates	103	44	70.8	1.75	
Fullerton	98	32	66.1	4.64	
Gallatin	88	29	63.0	1.22	
Grafton	94	38	67.8	0.35	
Jamestown	102	38	67.6	2.05	
La Moure				3.12	
Langdon	95	37	63.3	1.30	
Larimore	96	34	66.2	3.52	
Libson	93	34	66.3	3.67	
McKinney	95	29	62.9	2.18	
Manfred	96	36	66.4	1.06	
Mayville	95	26	62.4	0.24	
Medora	99	41	67.8	1.62	
Melville	101	35	68.6	1.44	
Milton	93	40	64.4	1.01	
Minnewaukon	94	34	66.8	1.24	
Minot	101	40	73.2	T.	
Minto	95	31	66.0	2.16	
Napoleon	108	34	69.4	1.28	
New England	98	40	66.8	1.70	
Oakdale	95	40	66.0	4.59	
Pembina	92	33	65.2	1.87	
Portal	94	38	62.3	3.08	
Power	94	37	67.6	2.82	
Steele	102	36	68.4	1.16	
University	94	38	67.5	2.12	
Wahpeton	92[e]	41[e]	66.8[e]	4.86	
Willow City	96	30	63.0	1.05	
Wishek	109	39	74.9	2.65	
Ohio.					
Akron	97	49	72.0	4.87	
Atwater				6.76	
Bangorville	95	48	72.8	2.92	
Bellefontaine	95[e]	47	72.4[e]	2.70	
Bement				4.70	
Benton Ridge	96	47	73.0	4.37	
Bladensburg	92	48	72.6	2.08	
Bloomingburg				1.18	
Bowling Green	95	53	72.8	4.27	
Bucyrus	94	45	72.0	4.72	
Cambridge	95	45	72.2	3.05	
Camp Dennison	99	49	75.6	2.79	
Canal Dover	95	46	71.6	2.49	
Canton	94	47	71.3	3.64	
Cardington	93	42	70.8	2.81	
Cedarville				1.62	
Chillicothe	99	49	76.2	2.35	
Circleville	95	50	74.6	2.02	
Clarington	96	50	74.0	4.80	
Clarksville	95	52	75.4	1.27	
Cleveland *a*	90	55	71.0	5.70	
Cleveland *b*	94	54	70.8	5.08	
Clifton	95	48	73.4	1.20	
Coalton	99	41	74.2	1.95	
Colebrook	91	45	69.1	5.79	
Dayton *a*				1.75	
Dayton *b*	99	49	75.2	1.43	
Defiance	94	45	72.0	3.92	
Delaware	95	45	72.5	2.04	
Elyria	96	48	71.9	5.64	
Findlay	99	48	74.7	4.69	
Frankfort	93	48	72.9	2.40	
Fremont	94	50	72.8	6.53	
Garrettsville	94	43	69.2	6.16	
Granville	95	45	72.7	2.07	
Gratiot	94	46	72.4	2.07	
Green	96	52	76.1	2.10	
Greenfield	95	53	76.1	1.70	
Greenhill	93	42	68.6	1.70	
Greenville	97	50	74.8	2.39	
Hanging Rock	97	50	75.6	3.00	
Hedges	95	45	72.6	4.51	
Hillhouse	93	45	68.6	5.62	
Hiram	91	52	70.0	5.27	
Hudson	96	47	70.3	7.70	
Jacksonboro	97	55	77.2	2.39	
Kenton	95	45	73.5	4.57	
Killbuck	93	45	71.4	2.67	
Lancaster	94	48	73.1	2.27	
Lima	100	45	71.8	2.21	
McConnelsville	94	47	73.0	3.74	
Manara	94	47	73.1	1.76	
Mansfield				3.75	
Marietta	92	53	74.7	3.33	
Marion	96	45	73.4	2.35	
Medina	94	47	72.0	6.20	
Milfordton	95	43	72.2	2.19	
Milligan	94	42	72.0	2.25	
Millport	92	43	69.0	5.64	
Montpelier	93	46	71.8	5.23	
Napoleon	93	52	72.4	4.80	
New Alexandria	95	48	73.4	4.70	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
New Berlin	96	45	71.3	3.13	
New Bremen	95	47	73.3	2.95	
New Richmond	97	54	76.7	2.16	
New Waterford	99	47	70.6	4.07	
North Lewisburg	93	48	73.0	2.19	
North Royalton	94	50	70.8	7.28	
Norwalk	98	48	73.4	5.94	
Oberlin	97	51	72.3	5.97	
Ohio State University	93	48	72.1	2.93	
Orangeville	94	42	69.8	6.87	
Ottawa	96	47	73.8	3.87	
Pataskala	94	46	72.5	3.01	
Philo	97	51	75.0	2.91	
Plattsburg	100	47	74.5	1.38	
Pomeroy	97	48	74.4	2.75	
Portsmouth *a*				3.46	
Portsmouth *b*	97°	52°	76.8°	3.67	
Pulse	95	50	75.0	1.31	
Richwood	94	46	72.4	3.03	
Ripley	96	51	74.5	2.37	
Rittman	96	47	71.8	4.39	
Rockyridge	96	49	72.9	4.19	
Shenandoah	92	46	70.7	4.59	
Sidney	96	49	74.3	2.49	
Somerset	95	50	75.0	3.53	
Springfield				2.29	
Strongsville				6.49	
Thurman	96	49	75.0	4.74	
Tiffin	94	50	73.0	5.45	
Upper Sandusky	96	46	73.7	2.71	
Urbana	91	47	71.1	5.69	
Vickery	97	50	72.4	5.48	
Walnut				2.93	
Warren	95	45	70.9	5.24	
Warsaw	104	42	73.2	1.44	
Wauseon	97	46	73.0	5.91	
Waverly	99	48	76.0	1.98	
Waynesville	93	51	73.4	2.01	
Wellington	97[a]	47[a]	72.0[f]	3.88	
Willoughby				3.42	
Wooster	94	42	71.8	4.61	
Zanesville				3.50	
Oklahoma.					
Arapaho	107	54	82.6	0.26	
Beaver	108	50	80.0	0.47	
Binger	103	55	79.6	1.32	
Blackburn	104	56	80.5	2.77	
Burnett	103	62	79.8	2.73	
Chandler	100	61	80.5	3.28	
Cleo	108	56	81.9	2.37	
Clifton	101	60	80.2	1.85	
Cloud Chief	106	55	80.4	0.25	
Eldorado	108	60	85.2	2.81	
Enid	105	57	80.6	2.40	
Fort Reno	105	58	80.8	1.65	
Fort Sill	105	60	82.1	0.00	
Grand	106	50	83.9	0.66	
Guthrie	101	60	80.0	2.03	
Hennessey	106	56	82.9	1.23	
Hobart	106	55	79.6	0.55	
Jefferson	108	59	82.4	2.22	
Jenkins	107	56	81.4	3.68	
Kenton	102	44	78.3	1.10	
Kingfisher	106	58	82.4	1.50	
Leger	106	63	83.5	0.80	
Mangum	107	66	84.1	1.60	
Newkirk	109	52	81.2	1.43	
Norman	101°	59°	79.6°	1.88	
Okeene	110	47	83.2	0.70	
Pawhuska	104	58	81.4	2.18	
Perry	106	59	81.6	1.99	
Sac and Fox Agency	102	65	83.0	1.92	
Shawnee	100	61	80.6	3.29	
Stillwater	102	60	80.4	3.47	
Taloga	111	60	85.1	0.68	
Temple	107	64	85.4	0.05	
Ural	116	58	81.0	0.60	
Watonga	107	55	81.2	2.36	
Waukomis	107	59	82.2	2.05	
Weatherford	105	52	81.1	0.17	
Oregon.					
Albany *b*				0.62	
Alpha	89	37	59.6	0.86	
Arlington	100	46	71.2	T.	
Ashland	92	39	64.9	0.57	
Astoria	78	51	62.9	0.98	
Aurora (near)	85	40	61.2	0.80	
Bay City	73	39	56.7	1.82	
Bend	89	28	57.3	0.42	
Beulah	100	31	67.2	0.18	
Blackbutte	85	40	61.8	0.30	
Blalock	105	42[f]	75.1[e]	T.	
Bullrun				1.93	
Cascade Locks	90	44	65.0	0.68	
Coquille				0.51	
Corvallis	86	42	62.0	0.34	
Coyote	105	42	74.4	0.04	
Dayville	93	40	64.8	0.13	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Oregon—Cont'd.	°	°	°	*Ins.*	*Ins*
Detroit	99	36	60.0	0.13	
Doraville	88	41	59.6	1.22	
Drain	93	40	64.6	0.65	
Ella				0.06	
Eugene	83[f]	43[f]	64.5[f]	0.41	
Fairview	78	36	57.0	0.85	
Falls City	89	40	60.7	0.17	
Forestgrove	98	39	63.2	0.22	
Gardiner	78	44	61.4	0.82	
Glenora	97	35	60.8	1.10	
Government Camp	83	30	50.7	3.08	
Grants Pass	98	37	65.6	0.24	
Grass Valley	90	32	59.4	0.20	
Hood River (near)	99	42	64.2	0.07	
Huntington	101	41	74.6	0.00	
Jacksonville	93	40	66.8	0.38	
Joseph	96	33	60.4	0.81	
Kerby	93	36	63.8	0.00	
Klamath Falls	98	29	65.1	0.00	
Lagrande	96	36	63.8	0.19	
Lakeview	90	30	64.0	0.46	
Langlois	69	41	57.4	0.30	
Lonerock	92	35	61.2	0.49	
McKenzie Bridge	90	33	60.7	0.77	
McMinnville	91	37	62.6	0.48	
Monroe	89	43	61.8	0.12	
Mount Angel	87	46	62.6	0.83	
Nehalem				1.71	
Newport	66	44	56.2	0.82	
Pendleton	102	31	69.4	0.06	
Pine	98	36	62.6	0.25	
Prineville	92	32	60.0	0.20	
Salem	87	48	63.6	0.40	
Sparta	97	34	66.6	0.39	
Stafford	91	47	62.4	1.09	
The Dalles	100	45	68.5	0.12	
Toledo	74	40	59.1	0.43	
Umatilla	107	49	74.4	0.08	
Vale	101	35	66.4	0.26	
Wallowa	96	34	61.0	0.58	
Wamic	93	36	64.0	0.00	
Warm Spring	97	36	66.4	0.10	
Weston	98	37	64.2	1.00	
Williams	96	37	62.8	0.45	
Pennsylvania.					
Aleppo	92	44	70.6	5.99	
Altoona	93	44	70.6	4.51	
Athens	92	40	68.8	3.57	
Beaver Dam				4.29	
Bellefonte	93	46	72.6	5.72	
Brookville				6.32	
Browers				3.76	
Butler	91	47	70.0	6.16	
California	94	47	73.9	3.56	
Cassandra	88	42	67.2	4.56	
Centerhall	93	44	70.8	3.91	
Clarion				5.18	
Coatesville	97	48	74.6	5.55	
Coudersport	97	38	66.5	5.53	
Confluence				5.90	
Davis Island Dam				4.14	
Derry	92	45	71.6	5.92	
Doylestown				6.30	
Dushore	92	35	66.1	5.05	
East Mauch Chunk	98	43	73.2	7.01	
Easton	94	48	72.4	6.65	
Ellwood Junction				6.24	
Emporium	91	45	69.6	8.42	
Ephrata	95	46	73.4	3.77	
Everett	92	47	71.8	7.02	
Forks of Neshaminy				6.07	
Franklin	92	43	69.0	6.98	
Freeport	93	46	72.0	3.65	
Gettysburg	97	52	75.7	4.48	
Girardville				6.19	
Gordon	92	38	68.8	6.48	
Grampian	90	39	68.6	5.15	
Greensboro				5.56	
Greenville	94	44	70.0	7.32	
Hamburg	98	46	72.9	8.21	
Hamlinton	90	41	66.4	6.20	
Hawthorn	92	44	69.6	5.05	
Herrs Island Dam				3.71	
Huntingdon *a*				4.52	
Huntingdon *b*	93	44	71.3	4.84	
Indiana	90	46	70.0	5.36	
Irwin	92	45	72.9	3.73	
Johnstown	92	48	72.8	4.97	
Keating				6.00	
Kennett Square	92	49	72.9	4.84	
Lansdale				4.02	
Lawrenceville	95	43	69.2	5.60	
Lebanon	97	45	73.4	3.94	
Leroy	89	43	67.8	4.17	
Lewisburg	96	45	71.4	5.73	
Lockhaven *a*	96	45	72.7	5.34	
Lockhaven *b*				4.63	
Lock No. 4				4.59	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lycippus	88	52	71.2	5.00	
Marion	93	50	73.6	5.54	
Mifflin				4.32	
Mifflintown	95	45	72.4	3.39	
Milford	95	40	69.4	4.80	
New Germantown	92	49	72.4		
Oil City				7.04	
Ottsville				8.11	
Parker				5.22	
Philadelphia	97	55	76.6	5.52	
Pocono Lake	87	38	65.7	5.90	
Point Pleasant				7.02	
Pottsville				8.81	
Quakertown	95	50	73.0	5.67	
Reading	95	48	74.3	5.12	
Renova *a*	92	47	70.4	4.48	
Renova *b*				4.70	
Saegerstown	92	40	68.1	5.54	
St. Marys	88	42	67.2	7.20	
Selsholtzville				3.87	
Selinsgrove	96	45	72.1	4.39	
Shawmont				5.83	
Smiths Corners				6.76	
Somerset	87	40	67.8	4.80	
South Bethlehem	93	47	72.2	7.85	
South Eaton	91	47	68.8	3.86	
Springmount				4.77	
State College	89	47	69.9	4.04	
Sunbury				3.35	
Swarthmore	96[1]	50[1]	74.0[1]	5.14	
Towanda	91	40	68.8	4.85	
Troutrun				5.73	
Uniontown	90	48	72.8	4.32	
Warren	91	44	69.0	6.06	
Wellsboro	93	40	68.9	5.27	
Westchester	94	52	74.6	5.92	
West Newton				6.06	
Windber				6.46	
Wilkesbarre	95	42	71.6	4.42	
Williamsport	92	47	71.5	6.08	
Rhode Island.					
Bristol	87	56	70.4	2.08	
Kingston	93	48	69.2	3.59	
Pawtucket	96	55	72.8	4.68	
Providence *a*	97	55	74.6	4.75	
Providence *c*	94	52	71.4	4.61	
South Carolina.					
Allendale	98	64	81.2	7.46	
Anderson	99	60	80.6	2.72	
Barksdale	99	60	79.8	2.14	
Batesburg	97	59	78.7	3.06	
Beaufort	98	68	80.9	3.45	
Bennettsville	100	62	80.9	5.15	
Blackville	101	62	81.4	1.77	
Bowman	99	64	81.5	8.09	
Calhoun Falls				3.61	
Camden				3.46	
Cheraw *a*	96	63	79.2	3.72	
Cheraw *b*				3.97	
Clarks Hill	100	64	81.2	2.64	
Clemson College	98	56	79.4	2.26	
Conway	98	5[illegible]	80.2	2.20	
Darlington	101	61	81.2	4.18	
Duewest	94[a]	62°	80.0[d]	3.14	
Edisto				6.05	
Effingham				3.41	
Florence	103	62	81.8	5.27	
Gaffney	103	58	81.8	1.47	
Gillisonville	96	62	79.9	8.54	
Greenville	93	58	76.2	4.04	
Greenwood	98	64	82.3	1.70	
Heath Springs	100	61	80.4	1.82	
Kingstree *a*	96	63	79.8	2.94	
Kingstree *b*				2.92	
Liberty	101	58	81.2	2.33	
Little Mountain	100	63	80.6	2.50	
Longshore	101	61	81.0	3.44	
Lugoff	102	60	81.4	1.88	
Pinopolis *1			78.2	4.43	
St. Georges	96	65	80.2	3.74	
St. Matthews	94	66	80.0	8.07	
St. Stephens				4.25	
Saluda	101	61	81.2	1.64	
Santuck	100	58	80.2	2.75	
Seivern	102	59	80.7	1.51	
Smiths Mills				6.69	
Society Hill	95	65	80.8	5.88	
Spartanburg	99	59	80.2	2.17	
Statesburg	97	64	80.6	3.63	
Summerville	95	60	79.0	3.13	
Sumter	99	63	81.8	4.90	
Trenton	101	65	81.1	1.81	
Trial	99	59	78.8	4.37	
Walhalla	96	45	78.2	2.41	
Walterboro	96	64	79.8	5.82	
Winnsboro	100	64	81.2	2.12	
Winthrop College	99	60	80.8	0.95	
Yemassee	97	64	80.4	5.68	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Yorkville	101	62	82.8	1.23	
South Dakota.					
Aberdeen	101	40	71.3	5.10	
Academy	101	50	72.6	5.08	
Alexandria	100	45	71.0	4.10	
Armour	101	45	72.4	3.56	
Ashcroft	97	41	68.4	1.88	
Bowdle	103e	42e	68.2e	4.32	
Brookings	90	40	67.0	3.30	
Canton	91	41	70.8	6.66	
Cavite	102	48	73.8	2.56	
Centerville				7.19	
Chamberlain	105	52	74.8	2.61	
Cherry Creek	106	44	71.5	3.86	
Clark	98	38	69.3	2.74	
Clear Lake	91	41	67.6	5.42	
Desmet	92d	42e	68.4d	3.19	
Doland	93	41	69.7	3.46	
Elkpoint	96	45	74.3	4.48	
Fairfax	95	52	72.0	5.81	
Farmingdale				3.02	
Faulkton	97	42	68.0	2.50	
Flandreau	90	44	67.4	4.68	
Forestburg	98	43	71.0	3.05	
Fort Meade	103	43	76.4	4.25	
Gannvalley	101	46	73.8	3.45	
Gettysburg	102	43	69.0	6.00	
Grand River School	105	42	71.2	2.53	
Greenwood	96	51	73.2	6.54	
Highmore				3.58	
Hitchcock				2.55	
Hotch City	103	49	73.4	2.41	
Howard	91	44	68.9	5.08	
Howell	101	43	70.2	2.85	
Ipswich	101	38	69.0	2.95	
Kimball	96	48	71.6	4.29	
Leola	103	38	69.6	1.29	
Marion	94d	44d	69.8d	4.35	
Mellette	97	40	68.6	2.76	
Menno	96	47	70.8	4.26	
Millbank	96	43	68.2	7.50	
Mitchell	97	47	71.4	5.77	
Oelrichs	102	47	71.0	3.15	
Pedro	105	47	72.6	5.65	
Pine Ridge	100	53	72.6	4.48	
Plankinton	96	46	71.8	5.38	
Ramsey	92	44	68.7	4.44	
Redfield	94	44	69.4	5.09	
St. Lawrence	100	42	71.0	3.09	
Silver City				3.52	
Sioux Falls	92	44	70.1	6.00	
Sisseton Agency	89	46	66.6	8.35	
Spearfish	95	46	68.2	2.99	
Tyndall	100	40	70.9	4.91	
Vermillion	95	48	73.4	4.70	
Watertown	92e	40e	66.5e	3.25	
Waubay	90	39	65.4	6.52	
Wentworth	91	42	68.5	5.46	
Wolsey				2.55	
Tennessee.					
Andersonville	93	50	75.5	6.08	
Arlington	98	57	80.8	1.76	
Ashwood	93	55	77.4	3.90	
Benton	94	53	76.0	6.19	
Bluff City				3.85	
Bolivar	97	57	80.4	1.51	
Bristol	93	53d	76.2b	7.92	
Byrdstown	92	54	76.0	3.16	
Carthage	96	55	76.8	1.76	
Charleston				4.00	
Clarksville	94	58	79.2	2.75	
Clinton				4.26	
Covington	96	60	80.6	4.09	
Decatur	94	53	77.2	5.50	
Dickson	90	55	75.9	4.21	
Dover	97	53	78.6	2.27	
Dyersburg	97	60	80.6	1.41	
Elizabethton	96	51	76.2	4.02	
Erasmus	91	45	72.7	3.62	
Florence	92	57	77.8	2.93	
Franklin	92	58	77.9	4.23	
Grace	96	58	80.0	4.80	
Greeneville	95	51	74.1	3.73	
Halls Hill				2.95	
Harriman	94	56	76.4	4.20	
Hohenwald	96	47	75.4	2.88	
Iron City	94	53	77.5	2.45	
Isabella	94	53	75.5	5.30	
Jackson	102	53	78.8	3.03	
Johnsonville	97	54	79.4	2.89	
Jonesboro	92	53	75.4	5.29	
Kenton	97	55	79.4	3.00	
Kingston				5.75	
Lafayette	96	61	79.6	3.95	
Leadvale				3.90	
Lewisburg	96	56	78.6	7.08	
Liberty	96	54	77.6	2.58	
Lynnville	93	58	77.6	4.09	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
McMinnville	95	54	76.7	4.04	
Maryville	98	56	78.4	5.45	
Milan	97	56	80.0	4.11	
Newport	94	56	77.4	4.32	
Nunnelly	95	52	76.4	2.80	
Oakhill	92	54	74.5	4.00	
Pope	98	50	79.2	0.97	
Rogersville	93	54	75.6	5.78	
Rugby	94	47	74.4	2.96	
Savannah	99	62	80.5	4.27	
Sewanee	87	56	74.4	5.09	
Silverlake	87	44	69.7	5.12	
Springdale	94	52	76.4	5.75	
Springville	96	60	80.3	3.29	
Tazewell				4.35	
Tellico Plains	97	54	77.0	5.58	
Tracy City	93	51	74.2	3.14	
Trenton	98	55	79.9	4.44	
Tullahoma	96	54	77.7	4.29	
Union City	96	56	79.5	3.74	
Waynesboro	96	52	78.4	3.86	
Wildersville	91	58	78.1	6.37	
Yukon	93	59	77.9	3.64	
Texas.					
Albany	98	68	82.5	0.27	
Alvin	95	71	74.6	9.14	
Anson				0.30	
Arthur				10.04	
Austin a	100	62	82.6	12.65	
Ballinger	100	65	81.8	1.47	
Beaumont	99	65	82.2	8.29	
Beeville	100	69	83.4	16.42	
Bigspring	106	64	83.8	0.36	
Blanco	95	62	77.6	12.01	
Boerne 1	98	64	76.7	9.50	
Bonham	98	67	81.0	16.03	
Booth				6.56	
Bowie	105	66	82.2	0.60	
Brazoria	92	69	80.8	7.98	
Brenham	100	68	81.4	8.61	
Brighton	90	69	81.5	6.08	
Brownwood	105	62	80.0	4.00	
Burnet	99	63	79.6	2.94	
Camp Eagle Pass	100	65	79.1	4.00	
Childress	108	61	84.2	1.75	
Clarksville	97	63	80.0	2.94	
Coleman	95	62	79.6	1.27	
College Station	110	52	81.9	6.58	
Colorado	108	62	83.8	0.16	
Columbia	93	67	80.8	11.33	
Comanche	101	61	80.5	T.	
Corsicana	104	59	82.5	12.06	
Cotulla	106	70	87.4	4.71	
Cuero	97	66	82.3	13.17	
Dallas	98	63	80.4	4.47	
Danevang	99	69	82.2	7.65	
Dublin	99	66	81.0	0.40	
Duval	95	66	78.8	12.04	
Estelle	100	66	81.3	3.24	
Fort Brown	98	73	84.4	0.53	
Fort Clark	96	60	77.1	4.93	
Fort Davis	96	58	76.8	0.15	
Fort McIntosh	102	67	85.0	8.59	
Fort Ringgold	101	70	86.4	3.00	
Fort Stockton				0.15	
Fredericksburg	96	62	79.6	2.58	
Gainesville	98e	64d	79.8d	11.66	
Gatesville	101	68	81.9	2.99	
Georgetown	96e	66e	80.8e	7.85	
Grapevine	101	66	80.2	2.75	
Greenville	102	66	82.8	7.80	
Hale Center	99	59	79.0	0.84	
Hallettsville	96	70	82.6	8.04	
Haskell	108	67	85.0	0.04	
Hearne	102	67	85.1	8.61	
Henrietta	109	64	84.6	0.14	
Hewitt				7.15	
Hillsboro	97	66	79.2	4.51	
Hondo	100	68	80.2	7.41	
Houston	98	70	82.6	4.35	
Huntsville	95	63	81.5	5.42	
Ira	107	61	82.7	0.28	
Jacksonville	97	65	79.6	7.33	
Junction				1.70	
Kaufman	98	67	82.1	5.73	
Kent	102	58	79.0	0.38	
Kerrville	98	60	77.2	3.49	
Kopperl				4.77	
Lampasas	100	66	80.4	2.08	
Lapara				11.10	
Laureles Ranch				7.11	
Llano	101	69	83.6	3.70	
Longview	101	57	81.6	5.90	
Luling	94	68	80.4	11.63	
McKinney	97	51	78.6	5.44	
Mann	98	64	80.2	12.72	
Marlin	98	67	81.2	17.72	
Menardville	101	59	80.6	0.90	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mount Blanco	102	59	80.5	0.07	
Nacogdoches	95	62	78.9	7.52	
New Braunfels	93	67	80.0	6.15	
Panter				2.51	
Paris	101	61	82.2	7.49	
Pearsall	100	67	83.0	7.10	
Port Lavaca	93	78	81.9	15.59	
Rhineland	105	64	83.3	0.15	
Rockisland	97	68	80.8	13.85	
Rockport	93	70	81.6	10.07	
Runge	100	64	83.8	13.91	
Sanderson	100	71	85.5	1.55	
San Saba	99	62	80.6	1.66	
San Marcos	98	66	81.0	8.96	
Santa Gertrude's Ranch				5.41	
Sherman	97	67	81.4	6.88	
Sonora	100	63	79.9	0.24	
Sugarland	95	65	81.0	5.61	
Sulphur Springs	95	66	80.4	6.78	
Temple b	97	60	80.0	6.76	
Trinity	98	65	81.6	4.93	
Tyler	100	67	82.6	6.93	
Victoria	98	68	82.3	10.55	
Waco	101	71	84.8	8.63	
Waxahachie	101	65	81.8	3.28	
Weatherford	101	67	82.8	3.68	
Weimar	99e	67e	81.6e	8.16	
Wharton	97	71	83.8	7.57	
Wichita Falls				0.03	
Utah.					
Alpine				0.08	
Aneth	100	46	77.1	0.38	
Blackrock	92	34	67.6	0.41	
Bluecreek	100	46	75.0	0.30	
Callao	95	39	73.8	0.95	
Castledale	104	33	68.8	0.74	
Corinne	99	40	72.0	0.08	
Coyoto	87b	37b	65.6b	0.47	
Emery	85	34	62.8	0.72	
Escalante	94	42	69.5	1.87	
Farmington	95	41	70.9	T.	
Fillmore	102	38	73.6	0.27	
Fort Duchesne	97	35	68.5	1.49	
Frisco	96	43	76.0	0.72	
Garrison	96	33	73.7	0.05	
Giles	101	39	75.2	0.85	
Government Creek	95	38	72.4	0.09	
Green River	107	43	79.2	0.37	
Grover	93	38	68.8	0.88	
Heber	92	32	64.0	0.69	
Henefer	92	30	64.6	0.40	
Hite	106	54	82.1	0.63	
Huntsville				0.22	
Ibapah	95	28	64.0	0.30	
Kanab	100	49	72.2	0.89	
Kelton	97	38	72.4	0.00	
La Sal	89	37	70.5	0.72	
Levan	91	37	68.8	0.47	
Loa	110	31	74.1	0.95	
Logan	91	43	68.6	0.35	
Lund	98	39	73.3	T.	
Manti	93	34	72.6	0.53	
Marysvale	92	33	66.6	0.64	
Meadowville	90	35	62.8	0.75	
Millville				0.45	
Moab	99	44	76.0	0.84	
Monticello	91	41	72.0	1.44	
Morgan	92	32	64.3	0.18	
Mount Nebo	98	38	74.4	0.14	
Mount Pleasant	95	36	69.5	0.56	
Ogden	95	39	74.6	0.07	
Park City	97	34	67.8		
Parowan	93	37	73.6	0.41	
Pinto	87	31	64.4	T.	
Plateau	89	29	68.6	0.95	
Promontory	97	60	75.2	0.00	
Provo	97	37	69.6	0.39	
Ranch	87	32	60.4	0.88	
Richfield	93	34	67.0	0.31	
St. George	108	48	77.6	1.50	
Salt Air	96e	54e	73.6e	T.	
Scipio	100	32	71.8	0.27	
Snowville	94	30	67.2	0.00	
Terrace	98	36	70.6	T.	
Thistle	103	41	75.1	0.53	
Tooele	97	45	73.9	0.05	
Tropic	89	39	68.2	0.59	
Vernal	96	36	70.0	1.83	
Wellington	99	34	70.8	1.05	
Woodruff	91	27	63.4	0.78	
Vermont.					
Burlington	90	51	70.3	6.68	
Cavendish	93	41	67.2	4.26	
Chelsea	87	41	64.4	3.86	
Cornwall	93	45	68.0	5.16	
Derby	87	42	64.7	5.08	
Enosburg Falls	89	38	65.8	5.02	
Hartland	90	40	65.4	4.15	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Vermont—Cont'd.	°	°	°	*Ins.*	*Ins.*
Jacksonville	80	41	61.2	3.84	
Manchester	87	39	66.2	2.70	
Morrisville	95	41	66.8	7.16	
Norwich	93	41	65.0	2.85	
St. Johnsbury	91	40	66.6	5.91	
Wells	90	40	67.0	2.69	
Woodstock	94	40	67.4	5.14	
Virginia.					
Alexandria	100	57	78.2	3.96	
Ashland	97	56	77.6	4.30	
Barboursville	95	52	76.2	1.11	
Bedford	100	51	79.2	1.79	
Bigstone Gap	92	57	74.0	3.85	
Blacksburg	90	45	71.8	6.29	
Bonair	98	56	77.8	5.17	
Boykins				2.78	
Buckingham	99	50	77.1	4.21	
Burkes Garden	86	38	66.8	4.65	
Callaville	94	57	75.4	7.95	
Charlottesville	95	56	76.8	2.40	
Clarksville				2.34	
Columbia	99	51	73.8	2.00	
Dale Enterprise	93	46	72.6	5.30	
Danville				1.61	
Elk Knob	89	56	73.9	3.67	
Farmville	99	58	78.9	5.40	
Fredericksburg	98	52	77.0	1.76	
Grahams Forge [a]	90	44	71.0	4.14	
Hampton	94	62	78.4	4.86	
Hot Springs	87	43	68.8	5.98	
La Crosse	98	60	79.0	4.70	
Lexington	95	48	74.5	3.39	
Lincoln	96	50	74.8	4.98	
Manassas	95	54	75.8	3.30	
Marion [d]	94	45	71.8	4.75	
McDowell	92	46	69.6		
Mendota				4.02	
Newport News	101	54	81.7	6.44	
Petersburg	96	57	77.9	4.31	
Quantico	99	56	78.2		
Radford				3.74	
Riverton				2.34	
Roanoke	93	49	71.8	1.14	
Rockymount	86	47	71.2	4.40	
Saxe	99	39	72.7	4.53	
Shenandoah				2.82	
Speers Ferry				2.82	
Spottsville	98	55	78.0	3.33	
Stanardsville	100	50	75.0	2.26	
Staunton	94	50	74.4	2.70	
Stephens City	96	50	74.2	3.29	
Warsaw	97	55	78.1	3.26	
Wilkerson	98	54	77.6	2.93	
Williamsburg	98	58	78.0	5.87	
Woodstock	98	50	75.4	1.57	
Wytheville	94	46	73.6	2.80	
Washington.					
Aberdeen	81	42	57.9	1.40	
Anacortes				0.62	
Ashford				2.59	
Blaine	77	43	59.2	1.97	
Bremerton	85	39	60.0	0.89	
Brinnon	86	46	61.8	1.23	
Cedonia	92	38	61.4	1.58	
Centralia	88	36	61.0	0.81	
Cheney				1.28	
Clearbrook	88	39	60.0	1.87	
Clearwater	83	42	58.8	1.77	
Cle Elum	97	37	60.2	0.32	
Colfax	97	34	62.4	0.97	
Colville	99	34	63.1	0.45	
Conconully	93	39	62.8	1.49	
Connell				0.50	
Coupeville	80	44	58.7	1.20	
Crescent	96	36	62.8	1.35	
Danville	98	40	64.6	3.02	
Dayton	97	38	66.2	0.67	
East Sound	84	38	58.4	0.98	
Ellensburg	96	40	63.7	0.05	
Ephrata	106	46	73.7	0.10	
Grandmound	87	38	60.7	0.40	
Granite Falls				1.14	
Hooper	107	42	69.5	0.54	
Horseheaven				0.16	
Ilwaco	74	47	58.0	3.58	
Lacenter	92	42	61.8	0.69	
Lakeside	95	49	69.4	0.27	
Lind	101	43	71.3	1.25	
Loomis	98	46	68.3	2.38	
Mayfield	92	40	60.9	1.90	
Mottinger Ranch	105	47	73.0	0.10	
Mount Pleasant	88	43	62.0	2.24	
Moxee	99	39	67.4	0.15	
Northport		36		1.74	
Odessa	105	32	67.0	0.12	
Olga	74	46	57.1	1.36	
Olympia	91	39	61.8	0.46	
Pasco	108			0.00	
Pinehill	100	42	66.4	0.04	
Pomeroy	106	36	68.2	1.24	
Port Townsend	81	46	58.8	0.90	
Rattlesnake	95	38	63.8	0.73	
Republic	96	35	60.6	2.13	
Ritzville				0.39	
Ritzville (near)				0.40	
Rosalia	95	36	62.3	0.83	
Sedro-Woolley	86	38	60.8	0.88	
Silvana	77[m]	40[m]	56.9[m]	0.36	
Snohomish	87	40	61.4	1.19	
Southbend	93	43	59.7	1.52	
South Ellensburg	100	42	66.6	T.	
Sprague				1.30	
Sunnyside	99	40	67.4	0.13	
Trinidad	106	50	76.2	0.02	
Twisp	101	41	64.0	1.50	
Union	85	39	61.2	0.85	
Usk	91	36	60.4	1.18	
Vancouver	96	45	64.2	0.37	
Vashon	81	46	60.8	0.86	
Waterville	98	38	65.0	0.45	
Wenatchee (near)	97	41	66.8	0.38	
Whatcom	78	33	59.0	1.29	
Wilbur	96	30	59.8	1.37	
Zindel	109	50	75.5	1.05	
West Virginia.					
Bayard	90	38	67.2	4.56	
Beverly	92	45	70.2	2.35	
Bluefield	90	46	71.3	2.61	
Burlington	94	45	72.0	3.94	
Byrne	95	43	75.8	2.80	
Cairo	97	45	74.0	2.00	
Central	94	44	72.2	3.70	
Chapel	96	54	74.7	3.54	
Charleston	100[e]	51[e]	77.0[e]	3.70	
Creston	98	42	74.2	3.12	
Cuba	93	47	73.3	4.37	
Dayton	94	44	70.5	2.40	
Echo	98	50	74.8	4.47	
Elkhorn	93	46	72.4	6.13	
Fairmont				6.58	
Glenville	97	47	73.8	2.69	
Grafton	93	45	71.6	3.75	
Green Sulphur Springs	94	47	71.2	3.34	
Harpers Ferry				4.87	
Hinton	92	49	74.1	3.22	
Huntington	97	52	76.2	1.82	
Josiah	95	50	74.0	4.28	
Leonard	87	45	69.0	2.29	
Lewisburg	92	48	71.1	5.05	
Lillydale	93	45	72.5	4.99	
Logan	97	50	75.6	5.33	
Mannington	94	47	72.4	4.81	
Marlinton	90	42	69.0	2.98	
Martinsburg	97	50	73.8	5.90	
Morgantown	90	47	72.2	5.46	
Moscow	64	47	70.8	2.55	
Moundsville	96	50	73.5	4.32	
New Martinsville	99	49	75.4	3.44	
Nuttallburg	93	45	72.2	3.45	
Oldfields	95	45	72.2	3.31	
Parsons	91	47	70.5	3.75	
Philippi	94	44	71.2	3.74	
Pickens [e]	91	42	69.4	3.60	
Point Pleasant	95	51	75.7	3.27	
Powellton	95	47	74.4	4.65	
Princeton	88	46	70.6	7.85	
Romney	94[m]	47[m]	74.2[m]	5.68	
Rowlesburg				4.10	
Ryan	96	45	73.3	2.79	
Smithfield	95[d]	44[d]	73.4[d]	3.62	
Southside	95	54	76.4	2.91	
Terra Alta	86	49	66.5	8.30	
Travellers Repose	89	37	66.1	4.16	
Uneeda	97	48	75.5	4.94	
Uppertract	94	44	72.2	2.37	
Valley Fork	93	46	73.4	2.17	
Webster Springs	100	41	71.8		
Wellsburg	91	49	71.4	5.24	
Weston				2.39	
Wheeling *a*	102	57	79.6	2.06	
Wheeling *b*				2.57	
Williamson	96	53	74.6	4.33	
Wisconsin.					
Antigo	91	38	67.2	4.15	
Appleton	90	41	69.8	6.75	
Ashland				6.55	
Barron	94	36	68.4	6.55	
Brodhead	95	48	72.5	5.59	
Butternut	88	32	64.8	9.88	
Chilton	91	46	69.4	2.79	
Chippewa Falls				5.28	
Citypoint	90	45	68.8	3.61	
Darlington	93	41	70.0	9.16	
Delavan	93	49	71.2	4.76	
Dodgeville	94	46	67.2	7.20	
Downing	89	37	66.2	8.78	
Easton	93	39	69.5	4.01	
Eau Claire	88	46	69.1	8.78	
Florence	88	39	66.1	7.42	
Fond du Lac	91	47	70.0	2.69	
Grand Rapids	88	44	68.6	6.35	
Grand River Locks				5.18	
Grantsburg	87	40	66.4	9.37	
Hancock	91	44	68.9	4.54	
Harvey	90	49	69.8	9.42	
Hayward	88	35	65.0	5.88	
Hillsboro	91	40	68.4	3.81	
Koepenick	92	33	66.3	7.10	
Lancaster	91	47	70.2	8.18	
Madison	89	53	71.2	7.17	
Manitowoc	92	48	68.2	7.92	
Meadow Valley	91	45	69.2	5.34	
Medford	93	38	68.8	7.40	
Menasha				4.50	
Neillsville	94	40	69.0	7.32	
New London	93	41	69.0	3.44	
North Crandon	85[g]	32[g]	63.6[g]	5.19	
Oconto	91	44	69.7	2.14	
Osceola	90	40	67.2	9.58	
Oshkosh	91	47	71.6	4.14	
Pine River	92	44	68.9	4.50	
Portage	90	48	70.9	4.19	
Port Washington	90	48	68.8	4.26	
Prairie du Chien *a*	99	50	73.6	8.94	
Prairie du Chien *b*				8.64	
Prentice	90[f]	34[f]	65.0[f]	0.80	
Racine	93	54	70.6	3.23	
Sheboygan	95	50	70.3	2.75	
Stevens Point	91	41	68.4	5.33	
Tomahawk	89	31	67.0	5.45	
Valley Junction	91	45	69.4	3.40	
Viroqua	88	43	68.3	5.58	
Watertown	91	44	69.0	8.88	
Waukesha	89	51	70.2	6.93	
Waupaca	91	42	69.4	3.05	
Wausau	89	41	68.0	7.92	
Whitehall	89	39	68.4	5.52	
Wyoming.					
Afton	88	30	59.0	1.15	
Alcova	98	41	70.6	0.94	
Basin	107	44	73.8	0.96	
Bedford	86	24	57.2	0.65	
Border	90	29	58.6	0.45	
Buffalo	94	37	64.8	2.03	
Chugwater	93	32	66.4	2.29	
Daniel	89	29	54.4	0.59	
Evanston	87	29	59.4	1.18	0.5
Fort Laramie	102	44	74.0	0.92	
Fort Washakie	92	34	66.5	0.80	
Fort Yellowstone	87	34	59.6	0.55	
Fourbear	83	32	57.2	0.65	T.
Griggs	97	35	67.3	1.38	
Hyattville	100	40	69.2		
Iron Mountain	91	37	65.6	1.86	
Laramie	84	36	62.6	1.31	
Leo	87	28	62.7	0.92	
Lolabama Ranch	85	26	55.0	0.92	
Lusk	94	40	66.0	5.65	
Marquette	92	34	63.1	0.73	
Moorcroft	100	41	68.8	1.62	
Moore	90	37	65.6	1.94	
Parkman	92[e]		66.3[e]	2.59	
Pinebluff	97	35	69.4	2.76	
Phillips	98[e]		69.6[f]	1.26	
Rawlins	99	37	66.8	1.26	
Redbank	94	37	66.8	1.50	
Rocksprings	91	40	64.3	0.39	
South Pass	88	18	57.7	1.00	T.
Tensleep	95	41	66.6	0.70	
Thayne	89	24	56.6	0.54	
Thermopolis	99	39	72.4	5.81	
Porto Rico.					
Adjuntas	90	58	74.5	8.05	
Aguirre	91	68	80.5	7.14	
Arecibo	90	69	78.8	5.15	
Barros	87	60	74.5	2.60	
Bayamon	89	60	75.2	4.05	
Caguas	93	67	80.0	6.88	
Canovanas	90	73	81.4	8.88	
Cayey	99	63	80.4	4.84	
Cidra	88	50	70.3	14.72	
Coamo	93	64	79.2	2.96	
Corozal *d*	95	62	79.1	6.43	
Fajardo	93	71	82.4	8.83	
Guanica	93	60	76.1	3.90	
Hacienda Coloso	93[d]	66	79.5	13.66	
Hacienda Josefa				9.53	
Hacienda Perla	93	72	82.0	14.47	
Humacao	91	76	84.2	8.88	
Isabela	90	68	81.0	2.69	
Juana Diaz	93	70	81.6	6.24	
La Carmelita	89	64	76.0	13.23	
La Isolina	96	65	79.2	3.98	
Lares	92	61	77.0	14.72	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Manati	95	68	80.7	6.02	
Maunabo	94	69	81.3	10.31	
Mayaguez	93	66	79.5	10.86	
Morovis	95	65	79.6	5.80	
Ponce	94	68	80.7	3.81	
Rio Piedras	.....	.....	.....	8.29	
San German	96	68	85.2	4.37	
San Lorenzo	91	65	77.5	9.25	
San Salvador	90	64	76.2	5.06	
Santa Isabel	92	66	80.4	8.35	
Utuado	95	67	80.7	5.60	
Vieques	91	69	80.8	5.78	
Yauco	94	70	81.0	3.11	
Mexico.					
Ciudad P. Diaz	96	60	79.1	3.31	
Coatzacoalcos	105	70	81.2	17.94	
Leon de Aldamas	86	56	70.0	5.89	
Vera Cruz	91	60	79.5	16.04	
New Brunswick.					
St. John	78	48	60.5	2.44	
Isthmus of Panama.					
Alhajuela	93	73	80.6	19.68	
Bohio	.....	.....	.....	11.10	
Colon	.....	.....	.....	16.73	
Gamboa	.....	.....	.....	13.46	
La Boca	87	73	79.4	7.01	
West Indies.					
Columbia, Isle of Pines	93	70	81.8	6.80	

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Alabama.					
Birmingham	91	49	73.5	3.40	
Alaska.					
Copper Center	96	30	57.0	1.38	
Fort Egbert	87	32	64.1	0.57	
Fort Liscum	72	32	48.8	3.24	
Juneau	79[a]	39[a]	55.3[a]	1.44	
Kenai	87	29	50.0	1.16	
Kotzebue	66	20	43.7	3.11	
Mine Harbor	65	32	47.2	1.01	
Wood Island	70	36	51.7	7.80	
Arizona.					
Champie Camp	114	42	74.2	.....	
Dragoon Summit	.....	.....	.....	T.	
Fort Apache	100	40	66.9	2.09	
Fort Grant	97	53	76.0	0.69	
California.					
Pilot Creek	.....	.....	.....	0.05	
San Miguel Island	76	50	58.6	0.18	
Indiana.					
Rensselaer	90	40	64.6	.....	
Kansas.					
Osage City	91	40	65.7	4.67	
Minnesota.					
Campbell	88	33	62.5	2.36	
New Jersey.					
Hanover	80	36	61.6	8.94	
North Carolina.					
Horse Cove	80	40	64.9	11.44	
North Dakota.					
Devils Lake	89	42	63.4	0.77	
SouthCarolina.					
Allendale	92	53	76.8	8.14	
South Dakota.					
Desmet	90[1]	31[b]	65.2[f]	5.79	

EXPLANATION OF SIGNS.

•Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "ᵃ" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

June, 1903, Kansas, Hays, make total precipitation, 4.40 instead of 4.46; Pennsylvania, Gettysburg, make mean temperature, 66.7 instead of 67.0; Texas, Sanderson, make mean temperature, 75.9 instead of 76.0; February, 1903; Texas, Mount Blanco, make total precipitation, 2.33 instead of 0.33.

NOTE.—The following change has been made in names of stations: Arizona, Mount Huachuca, changed to Upper San Pedro.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of July, 1903.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	11	32	3	25	s. 46 w.	30
Portland, Me	12	21	12	27	s. 59 w.	18
Concord, N. H	12	6	10	12	n. 18 w.	6
Northfield, Vt	17	33	13	12	s. 3 e.	16
Boston, Mass	14	12	8	39	n. 87 w.	31
Nantucket, Mass	11	26	2	38	s. 68 w.	39
Block Island, R. I	12	22	4	37	s. 73 w.	34
Narragansett, R. I.*	1	16	6	14	s. 28 w.	17
New Haven, Conn	21	17	5	29	n. 81 w.	24
Middle Atlantic States.						
Albany, N. Y	15	26	9	23	s. 52 w.	18
Binghamton, N. Y.†	12	7	7	15	n. 58 w.	9
New York, N. Y	17	18	5	38	s. 88 w.	33
Harrisburg, Pa	22	10	9	35	n. 65 w.	29
Philadelphia, Pa	22	18	6	30	n. 81 w.	24
Scranton, Pa	18	23	10	28	s. 74 w.	19
Atlantic City, N. J	20	21	3	31	s. 88 w.	28
Cape May, N. J	14	21	8	29	s. 72 w.	22
Baltimore, Md	24	13	4	33	n. 69 w.	31
Washington, D. C	22	20	9	24	n. 82 w.	15
Cape Henry, Va.†	7	14	2	15	s. 62 w.	15
Lynchburg, Va	10	18	11	35	s. 72 w.	25
Norfolk, Va	13	29	17	16	s. 3 e.	16
Richmond, Va	16	29	8	22	s. 47 w.	19
Wytheville, Va	17	17	6	37	w.	31
South Atlantic States.						
Asheville, N. C	19	22	14	20	s. 63 w.	7
Charlotte, N. C	12	27	15	24	s. 31 w.	18
Hatteras, N. C	11	25	14	32	s. 52 w.	23
Kittyhawk, N. C.*	9	12	10	12	s. 34 w.	4
Raleigh, N. C	19	21	13	27	s. 82 w.	14
Wilmington, N. C	13	27	9	32	s. 59 w.	27
Charleston, S. C	8	33	7	25	s. 36 w.	31
Columbia, S. C	14	30	14	19	s. 17 w.	17
Augusta, Ga	15	30	12	19	s. 25 w.	17
Savannah, Ga	7	35	7	26	s. 34 w.	34
Jacksonville, Fla	8	35	17	15	s. 4 e.	27
Florida Peninsula.						
Jupiter, Fla	9	23	30	11	s. 54 e.	24
Key West, Fla	7	18	37	10	s. 68 e.	29
Sand Key, Fla	2	11	20	6	s. 57 e.	17
Tampa, Fla	18	16	33	8	n. 85 e.	25
Eastern Gulf States.						
Atlanta, Ga	19	15	10	28	n. 77 w.	18
Macon, Ga.†	11	9	4	16	n. 81 w.	12
Pensacola, Fla.†	11	7	6	14	n. 63 w.	9
Mobile, Ala	17	23	7	24	s. 71 w.	18
Montgomery, Ala	17	26	12	19	s. 38 w.	11
Meridian, Miss.†	8	11	7	10	s. 45 w.	4
Vicksburg, Miss	11	24	18	20	s. 9 w.	13
New Orleans, La	9	28	16	23	s. 20 w.	20
Western Gulf States.						
Shreveport, La	10	31	25	11	s. 34 e.	25
Fort Smith, Ark	9	22	31	8	s. 61 e.	26
Little Rock, Ark	12	32	15	17	s. 6 w.	20
Corpus Christi, Tex	4	42	30	3	s. 36 e.	47
Fort Worth, Tex	3	42	23	6	s. 24 e.	42
Galveston, Tex	7	43	18	8	s. 16 e.	37
Palestine, Tex	4	44	16	12	s. 6 e.	40
San Antonio, Tex	4	36	43	1	s. 53 e.	53
Taylor, Tex †	1	23	10	3	s. 18 e.	23
Ohio Valley and Tennessee.						
Chattanooga, Tenn	13	20	6	35	s. 76 w.	30
Knoxville, Tenn	18	22	10	30	s. 79 w.	20
Memphis, Tenn	15	29	10	25	s. 47 w.	20
Nashville, Tenn	19	21	14	24	s. 79 w.	10
Lexington, Ky. †	6	12	9	15	s. 45 w.	8
Louisville, Ky	20	25	10	19	s. 61 w.	10
Evansville, Ind.†	8	13	7	8	s. 11 w.	5
Indianapolis, Ind	21	21	13	22	w.	9
Cincinnati, Ohio	18	20	18	25	s. 74 w.	7
Columbus, Ohio	17	22	16	24	s. 58 w.	9
Pittsburg, Pa	30	13	4	28	n. 55 w.	29
Parkersburg, W. Va	17	22	16	20	s. 39 w.	6
Elkins, W. Va	26	10	6	29	n. 55 w.	28
Lower Lake Region.						
Buffalo, N. Y	15	15	9	35	w.	26
Oswego, N. Y	9	18	7	37	s. 73 w.	31
Rochester, N. Y	14	18	7	36	s. 82 w.	29
Syracuse, N. Y	10	18	5	36	s. 76 w.	32
Erie, Pa	22	19	6	29	n. 83 w.	23
Cleveland, Ohio	15	24	11	25	s. 57 w.	17
Sandusky, Ohio †	7	10	3	17	s. 78 w.	14
Toledo, Ohio	12	17	9	36	s. 80 w.	28
Detroit, Mich	22	16	12	28	n. 69 w.	17
Upper Lake Region.						
Alpena, Mich	22	13	14	29	n. 59 w.	18
Escanaba, Mich	23	27	5	18	s. 73 w.	14
Grand Rapids, Mich	19	19	8	29	w.	21
Houghton, Mich.†	5	5	8	19	w.	11
Marquette, Mich	19	15	14	29	n. 75 w.	16
Port Huron, Mich	25	16	12	24	n. 53 w.	15
Sault Ste. Marie, Mich	17	9	18	32	n. 60 w.	16
Chicago, Ill	17	21	20	18	s. 27 e.	4
Milwaukee, Wis	19	20	10	25	n. 86 w.	15
Green Bay, Wis	14	27	14	24	s. 38 w.	16
Duluth, Minn	31	10	17	23	n. 16 w.	22
North Dakota.						
Moorhead, Minn	21	17	17	23	n. 56 w.	7
Bismarck, N. Dak	25	15	21	15	n. 31 e.	12
Williston, N. Dak	22	17	23	14	n. 61 e.	10
Upper Mississippi Valley.						
Minneapolis, Minn.*	13	11	6	8	n. 45 w.	3
St. Paul, Minn	23	21	17	22	n. 68 w.	5
La Crosse, Wis. †	9	14	4	9	s. 45 w.	7
Davenport, Iowa	16	19	17	24	s. 67 w.	8
Des Moines, Iowa	16	25	17	20	s. 18 w.	10
Dubuque, Iowa	21	16	15	25	n. 63 w.	11
Keokuk, Iowa	15	25	15	22	s. 35 w.	12
Cairo, Ill	17	31	10	19	s. 33 w.	17
Springfield, Ill	16	22	15	24	s. 56 w.	11
Hannibal, Mo. †	6	12	8	12	s. 34 w.	7
St. Louis, Mo	16	26	12	20	s. 39 w.	13
Missouri Valley.						
Columbia, Mo. *	5	13	9	18	s. 7 e.	8
Kansas City, Mo	10	33	24	11	s. 29 e.	26
Springfield, Mo	10	34	19	12	s. 74 e.	25
Topeka, Kans.*	5	16	9	3	s. 29 e.	12
Lincoln, Nebr	18	28	22	8	s. 54 e.	17
Omaha, Nebr	18	26	23	7	s. 63 e.	18
Valentine, Nebr	17	26	24	12	s. 53 e.	15
Sioux City, Iowa †	10	12	12	6	s. 72 e.	6
Pierre, S. Dak	17	20	27	13	s. 78 e.	14
Huron, S. Dak	22	20	22	11	n. 80 e.	11
Yankton, S. Dak. †	8	8	12	6	e.	6
Northern Slope.						
Havre, Mont	14	15	18	32	s. 86 w.	14
Miles City, Mont	24	14	16	19	n. 17 w.	10
Helena, Mont	14	23	6	36	s. 73 w.	31
Kalispell, Mont	6	13	13	39	s. 75 w.	27
Rapid City, S. Dak	16	16	19	25	w.	6
Cheyenne, Wyo	18	21	11	27	s. 79 w.	16
Lander, Wyo	19	16	9	30	n. 82 w.	21
North Platte, Nebr	11	27	28	10	s. 48 e.	24
Middle Slope.						
Denver, Colo	15	29	8	20	s. 41 w.	18
Pueblo, Colo	23	9	19	27	n. 30 w.	16
Concordia, Kans	10	33	26	5	s. 42 e.	31
Dodge, Kans	11	33	24	6	s. 39 e.	28
Wichita, Kans	9	39	20	5	s. 27 e.	34
Oklahoma, Okla	4	42	23	5	s. 25 e.	42
Southern Slope.						
Abilene, Tex	6	42	31	1	s. 40 e.	47
Amarillo, Tex	4	42	18	9	s. 13 e.	39
Southern Plateau.						
El Paso, Tex	14	8	36	16	n. 73 e.	21
Santa Fe, N. Mex	18	23	28	10	s. 74 e.	19
Flagstaff, Ariz	9	22	4	43	s. 71 w.	41
Phoenix, Ariz	15	10	22	29	n. 54 w.	9
Yuma, Ariz	1	36	12	26	s. 22 w.	38
Independence, Cal	18	24	18	23	s. 40 w.	8
Middle Plateau.						
Carson City, Nev	9	20	4	37	s. 72 w.	35
Winnemucca, Nev	20	17	15	26	n. 75 w.	12
Modena, Utah	3	23	6	42	s. 61 w.	40
Salt Lake City, Utah	17	19	31	12	s. 84 e.	19
Grand Junction, Colo	10	20	27	19	s. 39 e.	13
Northern Plateau.						
Baker City, Oreg	24	22	10	22	n. 81 w.	12
Boise, Idaho	16	22	11	27	s. 69 w.	17
Lewiston, Idaho †	1	6	23	3	s. 76 e.	21
Pocatello, Idaho	4	21	29	19	s. 30 e.	20
Spokane, Wash	18	23	17	16	s. 11 e.	5
Walla Walla, Wash	4	38	14	17	s. 5 w.	34
North Pacific Coast Region.						
North Head, Wash	35	9	3	34	n. 50 w.	40
Port Crescent, Wash.*	0	1	1	29	s. 88 w.	28
Seattle, Wash	17	18	18	23	s. 79 w.	5
Tacoma, Wash	28	9	5	27	n. 49 w.	29
Tatoosh Island, Wash	7	21	3	43	s. 71 w.	42
Portland, Oreg	25	19	10	27	n. 77 w.	18
Roseburg, Oreg	43	2	14	12	n. 3 e.	41
Middle Pacific Coast Region.						
Eureka, Cal	28	15	4	23	n. 56 w.	23
Mount Tamalpais, Cal	30	5	3	44	n. 59 w.	48
Red Bluff, Cal	19	26	23	13	s. 55 e.	12
Sacramento, Cal	5	48	15	9	s. 8 e.	43
San Francisco, Cal	2	15	0	52	s. 76 w.	53
Point Reyes Light, Cal.*	19	2	1	21	n. 50 w.	26
Southeast Farallon	34	5	0	45	n. 57 w.	54
South Pacific Coast Region.						
Fresno, Cal	34	2	2	46	n. 54 w.	54
Los Angeles, Cal	6	19	9	38	s. 66 w.	32
San Diego, Cal	28	11	3	34	n. 61 w.	35
San Luis Obispo, Cal	11	7	0	46	n. 85 w.	46
West Indies.						
Basseterre, St. Kitts, W. I‡	3	3	43	0	e.	43
Bridgetown, Barbados	11	4	55	0	n. 83 e.	56
Cienfuegos, Cuba ‡	28	3	39	2	n. 56 e.	45
Colon, Colombia, S. A. †	3	21	6	8	s. 6 w.	18
Grand Turk, W. I. †	2	5	27	1	s. 83 e.	26
Hamilton, Bermuda	11	22	13	30	s. 57 w.	20
Havana, Cuba †	1	3	30	0	s. 86 e.	30
Port of Spain, Trinidad †	1	14	24	0	s. 62 e.	27
Puerto Principe, Cuba	15	7	45	4	n. 79 e.	42
Roseau, Dominica, W. I.	13	6	20	3	n. 68 e.	18
San Juan, Porto Rico	1	12	53	0	s. 81 e.	54

* From observations at 8 p. m. only. † From observations at 8 a. m. only. ‡ Record for last 23 days. ‡ Record for 30 days only.

TABLE IV.—*Thunderstorms and auroras, July, 1903.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total No.	Total Days.	
Alabama	52	T.	....	4	3	1	2	7	9	5	6	5	8	8	2	....	....	....	....	....	4	....	....	....	6	4	2	1	5	4	10	9	8	113	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arizona	56	T.	....	....	....	....	1	8	6	6	5	7	5	9	2	13	11	6	2	2	2	5	6	13	6	6	7	2	2	1	....	....	....	133	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arkansas	57	T.	3	5	4	8	1	4	11	10	8	8	9	11	....	....	6	4	2	11	2	....	1	1	5	4	4	2	2	5	9	8	1	149	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
California	167	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	1	....	....	2	....	....	....	....	....	....	....	....	....	5	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Colorado	81	T.	1	4	8	....	1	6	13	4	9	8	8	3	12	15	12	16	13	11	5	4	11	12	11	10	5	7	9	4	3	3	5	233	30	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Connecticut	21	T.	2	1	....	....	....	....	....	....	1	10	5	11	4	15	8	....	....	1	....	10	11	13	3	....	1	5	....	....	14	14	2	131	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Delaware	5	T.	....	....	3	....	....	....	....	....	....	....	3	2	....	....	....	....	....	2	2	2	1	2	1	....	....	....	....	....	2	3	....	23	11	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	....	....	1	1	....	1	....	....	....	....	1	1	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	1	1	....	9	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	47	T.	13	10	8	8	7	8	13	9	8	16	14	14	12	9	5	3	2	1	4	10	10	12	13	19	15	10	12	12	11	11	9	308	31	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Georgia	55	T.	2	9	4	1	9	13	9	9	10	10	11	10	9	1	....	1	....	....	3	....	4	6	5	5	1	2	....	10	7	11	12	174	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Idaho	34	T.	1	1	....	2	1	2	1	3	2	....	1	....	....	....	....	3	....	3	....	....	2	11	12	....	....	....	....	....	....	4	....	49	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Illinois	92	T.	5	10	15	20	2	1	1	16	19	22	21	7	....	....	2	20	24	11	2	....	6	1	1	....	1	....	4	24	32	4	....	271	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Indiana	58	T.	8	5	2	10	10	....	1	8	8	11	23	14	....	....	1	6	8	9	2	1	17	6	....	....	....	....	3	15	26	7	....	201	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Indian Territory	11	T.	....	1	1	2	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	7	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Iowa	149	T.	14	14	19	12	....	....	3	35	30	34	13	3	1	2	5	7	40	3	....	22	14	7	1	....	1	13	5	38	21	....	1	358	5	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kansas	77	T.	7	2	17	9	....	....	2	1	2	6	20	5	10	12	11	15	13	2	....	....	1	4	1	....	....	....	....	2	15	20	19	196	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kentucky	41	T.	....	2	7	4	10	2	....	5	3	5	11	6	....	....	....	8	1	6	1	....	2	7	....	....	....	....	2	3	6	8	1	100	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	46	T.	4	8	8	15	5	7	6	13	12	8	11	15	6	....	1	....	2	1	2	2	....	....	1	10	12	13	13	10	13	12	13	223	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	19	T.	1	7	....	....	....	1	1	9	6	9	4	1	2	2	11	6	4	1	1	....	3	....	8	....	3	3	....	1	2	2	....	88	23	T.
		A.	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	2	2	A.
Maryland	48	T.	....	6	25	21	11	6	1	....	....	10	25	22	....	2	1	....	....	9	3	15	1	6	....	....	....	3	....	....	23	16	1	207	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Massachusetts	48	T.	11	....	....	2	....	6	....	3	1	2	1	4	3	19	5	7	....	3	....	19	25	28	7	1	....	6	....	....	28	22	....	203	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Michigan	106	T.	31	17	21	22	....	1	....	7	19	4	14	....	....	3	....	2	9	12	5	....	4	3	....	1	4	2	13	29	18	3	....	244	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Minnesota	67	T.	10	19	11	5	....	1	8	8	24	4	5	....	....	....	5	9	12	....	1	3	2	....	....	....	....	6	8	19	6	....	....	166	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Mississippi	44	T.	2	6	9	16	8	11	2	9	14	10	12	11	5	....	1	....	....	....	5	....	....	1	4	12	11	7	10	8	11	18	12	215	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Missouri	95	T.	9	1	10	25	....	....	13	12	3	14	44	13	2	14	26	29	32	14	....	19	40	20	24	....	....	....	3	31	28	16	9	451	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Montana	40	T.	5	4	4	2	2	3	8	4	3	3	2	....	5	4	2	1	3	....	5	2	5	10	8	8	7	9	5	2	4	7	4	131	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Nebraska	142	T.	15	16	28	3	3	1	12	20	7	20	18	17	33	5	25	23	33	2	3	11	7	16	1	3	6	4	4	27	31	11	34	439	31	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Nevada	40	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	2	2	....	....	....	....	....	....	....	....	....	5	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Hampshire	19	T.	....	....	....	....	....	....	....	2	....	2	....	....	....	4	4	2	1	3	1	8	8	6	7	1	....	....	....	....	5	6	....	60	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	2	2	A.
New Jersey	51	T.	....	15	21	3	....	....	....	....	....	8	31	24	4	14	2	....	1	12	6	21	3	27	10	....	....	6	....	....	18	27	5	258	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
New Mexico	31	T.	....	....	....	....	1	3	3	1	4	4	2	1	....	1	2	3	2	5	5	1	....	1	....	....	....	2	1	4	....	....	....	46	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New York	99	T.	16	7	13	1	23	1	....	....	....	30	12	4	1	48	7	3	....	....	2	54	23	55	4	....	2	2	....	3	47	32	3	393	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	2	2	A.
North Carolina	56	T.	....	4	9	19	13	21	2	1	6	2	8	11	13	....	1	2	4	....	13	6	1	7	2	1	1	1	6	8	6	18	16	202	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
North Dakota	48	T.	....	7	....	....	....	....	....	3	5	4	....	....	....	3	3	1	....	....	....	1	3	3	1	4	1	....	9	1	....	....	....	49	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Ohio	128	T.	15	14	9	25	10	1	....	1	15	23	14	6	2	8	....	....	....	1	9	8	8	35	10	....	....	....	1	1	1	41	20	1	279	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oklahoma	23	T.	....	....	4	7	1	....	....	1	....	1	3	4	....	1	....	....	....	2	4	....	....	1	....	....	....	....	....	....	1	5	....	1	36	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oregon	74	T.	....	....	....	4	2	2	2	1	....	....	1	....	....	....	....	....	....	....	11	9	12	3	6	5	....	....	....	....	....	....	....	58	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Pennsylvania	91	T.	1	12	31	12	21	....	....	1	....	26	27	16	6	16	2	....	....	7	15	31	1	13	1	....	1	6	....	1	35	17	....	299	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Rhode Island	7	T.	....	....	....	....	....	1	....	....	....	3	....	....	....	4	1	....	....	....	1	1	2	....	....	....	....	3	....	....	1	4	1	22	11	T.
		A.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
South Carolina	46	T.	2	8	3	1	20	14	7	3	6	4	5	10	13	1	....	1	1	1	4	1	2	7	5	....	1	....	1	7	4	11	13	156	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	56	T.	8	14	7	4	1	....	8	6	11	7	8	4	4	3	14	8	9	....	1	4	2	4	2	5	6	21	8	16	1	1	5	192	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Tennessee	56	T.	....	3	18	14	16	8	8	13	11	12	21	16	5	1	2	9	1	9	4	....	9	5	....	....	....	1	5	6	7	8	6	218	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Texas	95	T.	8	7	8	24	13	4	2	....	1	....	3	6	4	....	3	....	3	7	6	5	....	....	....	6	17	17	16	15	21	22	7	225	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Utah	47	T.	....	1	....	....	....	7	1	....	....	....	1	5	3	....	6	13	9	1	....	3	8	9	10	2	6	3	....	....	....	....	....	88	17	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	16	T.	2	2	....	....	....	....	....	1	1	3	1	....	....	3	3	1	....	....	....	8	6	9	3	....	2	1	....	....	1	1	....	48	17	T.
		A.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	2	2	A.
Virginia	50	T.	....	1	7	18	15	6	1	....	....	6	17	18	6	....	....	1	....	6	3	5	1	11	4	....	....	....	1	3	11	18	11	170	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	64	T.	2	4	....	7	3	4	4	6	4	....	6	1	4	....	....	....	1	3	2	....	....	15	11	1	....	....	....	....	....	....	....	78	17	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
West Virginia	43	T.	1	1	6	17	25	1	....	....	1	13	18	17	8	4	....	....	....	9	4	5	2	8	....	....	....	....	1	1	14	8	2	166	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Wisconsin	60	T.	18	24	20	14	....	....	3	14	31	8	1	....	....	....	....	1	10	1	1	2	6	....	....	....	....	8	3	9	23	2	....	199	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wyoming	31	T.	....	1	2	....	....	2	2	1	....	1	....	....	2	1	....	7	6	3	1	....	...	3	3	3	6	1	1	2	3	8	6	65	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2893	T.	217	277	366	359	237	165	163	251	296	383	468	331	183	229	188	218	251	197	139	303	291	383	186	106	137	165	171	324	537	411	208	8139	....	T.
		A.	2	0	0	0	1	0	0	0	0	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	4	0	0	0	0	12	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during July, 1903, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	14			0.60											0.60						
Alpena, Mich.	28	5:44 p. m.	9:25 p. m.	1.92	6:00 p. m.	7:12 p. m.	0.01	0.23	0.48	0.57	0.58	0.58	0.65	0.66	0.67	0.73	0.93	1.16	1.53	1.64	
Asheville, N. C.	5	2:45 p. m.	5:35 p. m.	1.51	2:58 p. m.	3:30 p. m.	0.05	0.24	0.61	0.90	1.13	1.26	1.35	1.39							
Do	28	3:15 p. m.	4:40 p. m.	1.24	3:20 p. m.	3:50 p. m.	0.02	0.34	0.63	0.87	1.00	1.12	1.17	1.19							
Atlanta, Ga.	28	1:01 p. m.	1:40 p. m.	0.76	1:08 p. m.	1:30 p. m.	T.	0.22	0.39	0.58	0.68	0.74									
Do	30	4:33 p. m.	5:00 p. m.	0.62	4:34 p. m.	4:47 p. m.	T.	0.30	0.53	0.61	0.62										
Atlantic City, N. J.	12	2:55 p. m.	4:45 p. m.	0.91	3:15 p. m.	3:45 p. m.	0.12	0.10	0.23	0.33	0.45	0.60	0.72								
Do	18	7:32 p. m.	8:50 p. m.	1.31	7:50 p. m.	8:45 p. m.	T.	0.11	0.19	0.29	0.57	0.63	0.64	0.64	0.74	0.94	1.14	1.30			
Do	22	5:45 p. m.	11:55 p. m.	5.40	5:47 p. m.	6:37 p. m.	T.	0.14	0.35	0.49	0.60	0.73	0.83	0.92	1.14	1.36	1.50				
					6:37 p. m.	7:30 p. m.		1.61	1.75	1.94	2.22	2.55	2.89	3.11	3.44	3.63	3.83	3.99	4.15	4.58	4.72
Augusta, Ga.	13			0.66														0.57			
Baltimore, Md.	12	12:01 p. m.	1:10 p. m.	2.87	12:04 p. m.	12:37 p. m.	T.	0.33	0.98	1.72	2.23	2.52	2.69	2.87							
Do	30	4:10 p. m.	6:10 p. m.	1.04	4:33 p. m.	4:55 p. m.	T.	0.03	0.18	0.64	0.93	1.00									
Binghamton, N. Y.	22			0.50														0.33			
Bismarck, N. Dak.	1–2			1.17														0.60			
Block Island, R. I.	26			0.30									0.30								
Boise, Idaho.	6–7			0.07														0.05			
Boston, Mass.	30			0.42														0.40			
Buffalo, N. Y.	30			0.89														0.62			
Cairo, Ill.	11	3:45 p. m.	9:00 p. m.	1.28	4:02 p. m.	5:00 p. m.	0.01	0.08	0.19	0.24	0.33	0.37	0.40	0.45	0.54	0.59	0.81	0.98			
Do	15	5:45 a. m.	8:20 a. m.	0.86	7:40 a. m.	8:05 a. m.	0.20	0.15	0.20	0.35	0.43	0.62	0.64								
Charleston, S. C.	13–14	8:35 p. m.	5:05 a. m.	1.75	12:35 a. m.	1:40 a. m.	0.40	0.14	0.30	0.36	0.38	0.48	0.52	0.53	0.54	0.62	0.71	0.83	1.06		
Charlotte, N. C.	13			0.55														0.43			
Chattanooga, Tenn.	9			0.45														0.41			
Chicago, Ill.	9	9:10 p. m.	10:25 p. m.	1.09	9:22 p. m.	9:50 p. m.	0.04	0.10	0.27	0.62	0.70	0.84	0.91	0.94	0.99	1.02	1.06				
Cincinnati, Ohio.	21	9:45 p. m.	11:50 p. m.	1.18	10:01 p. m.	10:35 p. m.	0.01	0.15	0.44	0.60	0.70	0.81	0.91	1.01	1.03						
Cleveland, Ohio.	17–18			1.67														0.71			
Columbia, Mo.	11	6:08 p. m.	7:28 p. m.	0.80	6:15 p. m.	6:45 p. m.	T.	0.08	0.24	0.34	0.50	0.67	0.75	0.78							
Columbia, S. C.	10			0.84														0.53			
Columbus, Ohio.	10			0.78														0.77			
Concord, N. H.	21	5:10 a. m.	11:30 a. m.	1.87	8:00 a. m.	9:00 a. m.	0.35	0.09	0.17	0.19	0.26	0.30	0.33	0.49	0.62	0.82	1.07	1.25			
Do	30	1:20 p. m.	2:37 p. m.	1.68	1:39 p. m.	2:20 p. m.	0.01	0.55	0.80	0.83	0.83	0.93	1.16	1.25	1.40	1.61	1.65				
Corpus Christi, Tex.	1	3:15 p. m.	8:30 p. m.	2.41	6:39 p. m.	7:45 p. m.	0.76	0.23	0.36	0.43	0.45	0.49	0.53	0.54	0.55	0.72	1.15	1.71	1.93		
Davenport, Iowa.	2	12:10 a. m.	12:40 a. m.	0.70	12:15 a. m.	12:32 a. m.	0.01	0.12	0.34	0.68	0.71										
Denver, Colo.*	3			0.47																	
Des Moines, Iowa.	3			0.92														0.72			
Detroit, Mich.	17–18	8:50 p. m.	4:15 a. m.	2.69	1:25 a. m.	2:15 a. m.	0.52	0.05	0.10	0.15	0.20	0.29	0.42	0.61	0.81	0.93	1.07				
					2:15 a. m.	3:15 a. m.		1.17	1.25	1.32	1.39	1.49	1.55	1.63	1.71	1.78	1.86	2.02	2.13		
Dodge, Kans.	30			0.38														0.23			
Dubuque, Iowa.	9	12:40 a. m.	8:10 a. m.	1.75	1:55 a. m.	2:25 a. m.	T.	0.14	0.30	0.43	0.54	0.77	0.84	0.86							
Duluth, Minn.	7–8			0.71														0.49			
Eastport, Me.	10	1:20 p. m.	3:35 p. m.	1.10	2:15 p. m.	3:10 p. m.	0.16	0.31	0.43	0.48	0.51	0.63	0.71	0.82	0.90	0.97	1.01	1.10			
Elkins, W. Va.	30			1.18														0.53			
Erie, Pa.	18			1.23														0.44			
Escanaba, Mich.	21	12:35 p. m.	1:30 p. m.	1.91	12:35 p. m.	1:10 p. m.	0.00	0.10	0.79	1.42	1.62	1.65	1.77	1.87	1.90						
Do	28	1:15 a. m.	8:03 a. m.	1.63	3:35 a. m.	4:15 a. m.	0.37	0.07	0.21	0.38	0.53	0.70	0.80	0.88	0.98	1.02					
Evansville, Ind.	16	8:11 a. m.	12:46 p. m.	1.63	9:55 a. m.	10:10 a. m.	0.25	0.41	0.61	0.66											
Fort Smith, Ark.	4			1.11														0.54			
Fort Worth, Tex.	2			0.88														0.41			
Galveston, Tex.	1	12:01 a. m.	3:53 p. m.	6.71	3:55 a. m.	4:55 a. m.	1.87	0.12	0.32	0.48	0.58	0.67	0.81	0.98	1.13	1.22	1.32	1.62			
Do	25	12:40 p. m.	1:55 p. m.	1.14	12:40 p. m.	1:05 p. m.	0.00	0.09	0.42	0.71	0.99	1.12	1.13								
Do	26	1:30 a. m.	7:40 a. m.	1.93	1:40 a. m.	2:05 a. m.	0.04	0.10	0.12	0.32	0.63	0.72	0.74	0.74	0.81						
Do	27	7:15 a. m.	7:50 a. m.	0.72	7:17 a. m.	7:45 a. m.	T.	0.24	0.33	0.35	0.53	0.70	0.72								
Grand Junction, Colo.	16			0.31														0.24			
Grand Rapids, Mich.*	4			1.74																	
Green Bay, Wis.	1			0.67														0.52			
Harrisburg, Pa.	18			0.82														0.20			
Hatteras, N. C.	13–14			1.44														0.50			
Huron, S. Dak.	26	2:39 a. m.	6:07 a. m.	0.94	2:39 a. m.	3:00 a. m.	0.00	0.13	0.31	0.56	0.69	0.74	0.77	0.80							
Indianapolis, Ind.	12	1:45 a. m.	5:30 a. m.	1.45	1:45 a. m.	2:25 a. m.	0.00	0.07	0.15	0.29	0.37	0.48	0.65	0.75	0.87	0.91	0.94	1.02			
Jacksonville, Fla.	29	1:52 p. m.	5:40 p. m.	0.69	3:30 p. m.	3:46 p. m.	0.13	0.26	0.38	0.50	0.52										
Jupiter, Fla.	15	12:56 p. m.	2:20 p. m.	0.79	1:00 p. m.	1:25 p. m.	T.	0.17	0.42	0.56	0.66	0.74	0.77								
Kalispell, Mont.	7			0.32														0.15			
Kansas City, Mo.	11	4:30 a. m.	8:05 a. m.	1.19	4:38 a. m.	5:27 a. m.	0.04	0.11	0.13	0.26	0.32	0.39	0.42	0.47	0.62	0.74	0.82				
Do	14	12:05 a. m.	3:35 a. m.	0.75	1:20 a. m.	1:32 a. m.	0.15	0.13	0.43	0.51	0.53	0.55									
Key West, Fla.	15	2:40 p. m.	4:15 p. m.	1.02	2:40 p. m.	3:30 p. m.	0.00	0.12	0.13	0.21	0.36	0.40	0.45	0.60	0.77	0.92	0.99	1.01			
Knoxville, Tenn.	16			0.76														0.48			
La Crosse, Wis.	3–4	9:45 p. m.	5:30 a. m.	1.37	11:20 p. m.	11:55 p. m.	0.22	0.08	0.12	0.34	0.53	0.58	0.67	0.78	0.82						
Do	9	2:25 p. m.	7:50 p. m.	1.27	3:05 p. m.	3:25 p. m.	0.06	0.13	0.55	0.96	1.01										
Lewiston, Idaho.	4			0.27														0.18			
Lexington, Ky.	30	4:44 p. m.	6:20 p. m.	0.82	4:47 p. m.	5:15 p. m.	T.	0.20	0.41	0.58	0.68	0.74	0.79								
Lincoln, Nebr.	15	5:30 p. m.	7:52 p. m.	0.83	7:11 p. m.	7:25 p. m.	0.01	0.24	0.65	0.72	0.74	0.79	0.82								
Little Rock, Ark.	11	1:00 p. m.	3:40 p. m.	2.48	1:00 p. m.	1:45 p. m.	0.00	0.11	0.40	0.69	0.99	1.37	1.74	2.02	2.23	2.29					
Do	12	6:25 p. m.	9:40 p. m.	0.83	6:33 p. m.	7:00 p. m.	T.	0.11	0.27	0.47	0.54	0.62	0.68	0.72							
Do	29	3:54 p. m.	6:50 p. m.	1.12	4:07 p. m.	4:40 p. m.	T.	0.18	0.33	0.37	0.55	0.82	0.98	1.02							
Los Angeles, Cal.†																					
Louisville, Ky.	11			0.52														0.46			
Lynchburg, Va.	4			0.66														0.63			
Macon, Ga.	6	3:15 p. m.	5:10 p. m.	2.13	3:20 p. m.	4:25 p. m.	T.	0.21	0.52	0.69	0.72	1.05	1.26	1.35	1.37	1.42	1.50	1.73	1.83	2.13	
Memphis, Tenn.	11	12:45 p. m.	4:15 p. m.	0.51	1:08 p. m.	1:32 p. m.	T.	0.07	0.26	0.38	0.44	0.49									
Meridian, Miss.	11	11:58 a. m.	2:05 p. m.	1.67	12:35 p. m.	1:50 p. m.	0.08	0.19	0.45	0.54	0.54	0.55	0.56	0.56	0.70	0.75	0.78	1.19	1.31		
Do	30	5:53 p. m.	6:48 p. m.	1.51	5:55 p. m.	6:40 p. m.	0.01	0.16	0.31	0.55	0.75	0.92	1.09	1.15	1.36	1.50					
Milwaukee, Wis.	17–18			2.47														0.69			
Montgomery, Ala.	31	12:12 p. m.	12:40 p. m.	0.65	12:12 p. m.	12:27 p. m.	0.00	0.12	0.42	0.62	0.64										
Nantucket, Mass.	13			0.82														0.39			
Nashville, Tenn.	11	1:20 p. m.	1:55 p. m.	0.80	1:24 p. m.	1:40 p. m.	T.	0.21	0.35	0.42	0.46	0.49									
New Haven, Conn.	26			0.32							0.32										
New Orleans, La.	4	11:55 a. m.	1:10 p. m.	1.53	12:03 p. m.	12:50 p. m.	T.	0.15	0.40	0.60	0.76	1.08	1.17	1.27	1.39	1.45	1.50				
Do	25	1:30 p. m.	3:25 p. m.	0.99	1:37 p. m.	1:55 p. m.	T.	0.26	0.55	0.81	0.90	0.91									
New York, N. Y.	22	2:50 p. m.	3:50 p. m.	0.55	3:20 p. m.	3:45 p. m.	T.	0.06	0.08	0.17	0.40	0.49									
Do	30	5:23 p. m.	6:40 p. m.	0.46	5:23 p. m.	5:48 p. m.	0.00	0.10	0.28	0.38	0.42										
Norfolk, Va.	13			1.85														0.70			
Northfield, Vt.	22			0.43														0.32			
North Head, Wash.																					
Oklahoma, Okla.	4	1:22 a. m.	4:15 a. m.	0.90	2:02 a. m.	3:00 a. m.	0.03	0.06	0.12	0.16	0.22	0.25	0.26	0.27	0.30	0.48	0.63	0.75			
Omaha, Nebr.	29	1:00 a. m.	6:05 a. m.	0.96	3:50 a. m.	4:20 a. m.	0.09	0.04	0.13	0.34	0.47	0.52	0.59	0.61							
Palestine, Tex.	4	2:43 p. m.	6:30 p. m.	1.51	2:44 p. m.	3:50 p. m.	T.	0.13	0.27	0.35	0.42	0.56	0.68	0.76	0.82	1.01	1.19	1.28	1.41		
Do	25	4:20 p. m.	8:30 p. m.	0.96	6:12 p. m.	6:35 p. m.	T.	0.23	0.52	0.62	0.70	0.74	0.76								
Do	30	6:30 a. m.	12:10 p. m.	2.21	7:00 a. m.	8:20 a. m.	0.01	0.11	0.20	0.49	0.60	0.74	0.90	0.93							
Parkersburg, W. Va.	5	2:31 p. m.	5:58 p. m.	1.78	2:36 p. m.	3:58 p. m.	T.	0.04	0.09	0.19	0.31	0.33	0.61	0.74	0.75	0.78	0.84	1.06	1.51		
Pensacola, Fla.	9–10	11:31 p. m.	2:30 a. m.	1.13	11:47 p. m.	1.05 a. m.	0.06	0.15	0.37	0.61	0.72	0.75									

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Pensacola, Fla	9–10	11:31 p. m.	2:30 a. m.	1.13	11:47 p. m.	1:05 a. m.	0.06	0.15	0.37	0.61	0.72	0.75	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	10	9:43 a. m.	2:58 p. m.	2.55	9:46 a. m.	11:00 a. m.	0.01	0.28	0.54	0.66	0.93	1.17	1.43	1.66	1.80	1.89	1.98	2.16	2.41	.....	.....
Philadelphia, Pa	18	3:50 p. m.	6:20 p. m.	0.87	5:15 p. m.	5:50 p. m.	0.07	0.06	0.09	0.10	0.14	0.28	0.67	0.74	0.78	.....	.....	.....	.....	.....	.....
Pittsburg, Pa	4	2:40 p. m.	3:25 p. m.	1.47	2:45 p. m.	3:10 p. m.	T.	0.25	0.78	1.17	1.36	1.43	1.46	.....	.....	.....	.....	.....	.....	.....	.....
Do	5	4:40 p. m.	6:15 p. m.	1.29	5:17 p. m.	6:00 p. m.	0.37	0.09	0.24	0.43	0.66	0.80	0.83	.....	.....	.....	.....	.....	.....	.....	.....
Do	20	2:20 p. m.	3:15 p. m.	0.69	2:43 p. m.	2:52 p. m.	0.05	0.34	0.57	0.59	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pocatello, Idaho	22–23	.....	.....	0.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	.....	.....
Portland, Me	20–21	.....	.....	0.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.33	.....	.....	.....
Portland, Oreg	5	.....	.....	0.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.08	.....	.....	.....
Pueblo, Colo	22–23	.....	.....	0.49	.....	.....	.....	.....	.....	.....	.....	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....
Raleigh, N. C	27	10:30 p. m.	11:22 p. m.	1.46	10:50 p. m.	11:20 p. m.	T.	0.05	0.13	0.36	0.81	1.23	1.45	1.46	.....	.....	.....	.....	.....	.....	.....
Do	28	12:30 a. m.	3:30 a. m.	1.46	2:05 a. m.	3:00 a. m.	0.12	0.05	0.15	0.22	0.33	0.48	0.56	0.70	0.94	1.08	1.19	1.28	.....	.....	.....
Richmond, Va	4	4:00 p. m.	8:50 p. m.	1.45	4:18 p. m.	5:03 p. m.	T.	0.11	0.43	0.62	0.75	0.81	0.88	0.91	1.03	1.24	.....	.....	.....	.....	.....
Rochester, N. Y	5	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.42	.....	.....	.....
Sacramento, Cal. †	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo	29	6:10 p. m.	8:03 p. m.	1.46	6:35 p. m.	7:39 p. m.	0.02	0.14	0.18	0.41	0.53	0.71	1.01	1.11	1.22	1.27	1.33	1.40	.....	.....	.....
St. Paul, Minn	2	1:15 p. m.	3:35 p. m.	0.81	2:03 p. m.	2:50 p. m.	0.03	0.05	0.06	0.09	0.21	0.31	0.37	0.47	0.57	0.64	0.72	.....	.....	.....	.....
	2	9:42 p. m.	11:58 p. m.	1.75	10:15 p. m.	11:58 p. m.	0.03	0.05	0.15	0.30	0.40	0.47	0.65	0.80	1.01	1.11	1.28	1.38	1.59	1.72	.....
Do	9	8:05 a. m.	9:50 a. m.	0.63	8:45 a. m.	9:00 a. m.	0.04	0.31	0.46	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Salt Lake City, Utah	16	.....	.....	0.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
San Antonio, Tex	1–2	11:20 p. m.	5:50 a. m.	1.43	3:35 a. m.	4:35 a. m.	0.04	0.12	0.32	0.52	0.61	0.64	0.68	0.74	0.78	0.82	0.84	1.12	.....	.....	.....
Do	4–5	11:30 p. m.	8:42 a. m.	2.02	11:34 p. m.	12:25 a. m.	T.	0.18	0.37	0.59	0.83	1.07	1.10	1.19	1.25	1.30	1.37	1.43	.....	.....	.....
Do	5	6:40 p. m.	9:35 p. m.	0.84	8:29 p. m.	8:46 p. m.	0.05	0.11	0.58	0.71	0.78	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	27	11:08 a. m.	12:35 p. m.	0.98	12:10 p. m.	12:23 p. m.	0.20	0.51	0.72	0.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Diego, Cal. †	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sandusky, Ohio	17–18	9:20 p. m.	8:05 a. m.	2.41	1:25 a. m.	3:20 a. m.	0.53	0.04	0.10	0.18	0.21	0.27	0.34	0.38	0.40	0.43	0.46	0.54	0.91	1.21	1.50
San Francisco, Cal †	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Savannah, Ga	9	D. N.	4:43 p. m.	4.08	10:45 a. m.	11:45 a. m.	1.18	0.10	0.17	0.26	0.40	0.54	0.69	0.99	1.30	1.54	1.79	1.91	2.09	2.42	2.63
Do	22	2:55 p. m.	4:30 p. m.	0.70	3:15 p. m.	3:40 p. m.	T.	0.16	0.31	0.49	0.60	0.67	0.70	.....	.....	.....	.....	.....	.....	.....	.....
Do	11	12:18 p. m.	1:36 p. m.	0.50	12:26 p. m.	12:35 p. m.	T.	0.32	0.38	0.41	0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Scranton, Pa	4–5	.....	.....	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.29	.....	.....	.....
Seattle, Wash	12	4:00 p. m.	5:50 p. m.	0.59	4:04 p. m.	4:30 p. m.	T.	0.18	0.35	0.43	0.48	0.54	0.56	.....	.....	.....	.....	.....	.....	.....	.....
Shreveport, La	5	.....	.....	0.73	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.39	.....	.....	.....
Spokane, Wash	11	.....	.....	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.54	.....	.....	.....
Springfield, Ill	5	4:20 p. m.	7:30 p. m.	1.14	4:40 p. m.	5:20 p. m.	0.04	0.08	0.24	0.51	0.72	0.78	0.84	0.86	0.93	0.96	0.99	.....	.....	.....	.....
Syracuse, N. Y	10	6:05 p. m.	7:20 p. m.	2.30	6:07 p. m.	7:10 p. m.	T.	0.19	0.40	0.71	0.94	1.23	1.49	1.80	1.95	2.06	2.15	2.26	2.30	.....	.....
Tampa, Fla	29	5:50 a. m.	8:10 a. m.	1.20	5:58 a. m.	6:53 p. m.	T.	0.05	0.09	0.11	0.12	0.14	0.33	0.59	0.81	0.94	1.01	1.10	.....	.....	.....
Do	29	8:14 p. m.	11:55 p. m.	1.32	8:22 p. m.	9:02 p. m.	T.	0.13	0.32	0.61	0.82	0.94	1.02	1.06	1.15	.....	.....	.....	.....	.....	.....
Taylor, Tex	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	29	4:17 a. m.	4:40 p. m.	6.19	6:29 a. m.	6:55 a. m.	0.71	0.09	0.15	0.21	0.50	0.70	0.99	1.31	.....	.....	.....	.....	.....	.....	.....
Do					7:30 a. m.	8:20 a. m.	2.08	0.07	0.49	1.00	1.27	1.36	1.50	1.60	1.95	2.40	2.73	.....	.....	.....	.....
					8:20 a. m.	9:00 a. m.	.....	2.98	3.21	3.30	3.37	3.43	3.47	3.56	3.60	.....	.....	.....	.....	.....	.....
Toledo, Ohio	18	8:30 p. m.	D. N.	2.28	12:30 a. m.	1:30 a. m.	0.55	0.07	0.17	0.27	0.36	0.44	0.52	0.59	0.72	0.79	0.88	1.04	.....	.....	.....
Topeka, Kan	16–17	.....	.....	1.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.58	.....	.....	.....
Valentine, Nebr	16–17	10:00 p. m.	7:45 a. m.	1.65	11:55 p. m.	12:40 a. m.	0.30	0.08	0.15	0.22	0.28	0.34	0.45	0.71	0.85	0.90	.....	.....	.....	.....	.....
Vicksburg, Miss	12	.....	.....	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.69	.....	.....	.....
Washington, D. C	12	12:08 p. m.	7:18 p. m.	2.81	12:15 p. m.	1:10 p. m.	0.02	0.23	0.58	0.99	1.00	1.15	1.31	1.34	1.36	1.38	1.58	1.72	.....	.....	.....
Wichita, Kans	30	.....	.....	0.56	.....	.....	.....	.....	.....	.....	.....	.....	0.55	.....	.....	.....	.....	0.56	.....	.....	.....
Wilmington, N. C	13	8:10 p. m.	D. N.	0.96	9:30 p. m.	10:25 p. m.	0.04	0.09	0.22	0.40	0.49	0.56	0.56	0.57	0.59	0.65	0.75	0.83	.....	.....	.....
Wytheville, Va	12–13	.....	.....	2.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Yankton, S. Dak	17	.....	.....	2.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Bridgetown, Barbados	7	1:26 p. m.	4:20 p. m.	1.45	1:40 p. m.	2:40 p. m.	0.06	0.12	0.31	0.44	0.44	0.53	0.53	0.53	0.59	0.79	0.89	1.15	.....	.....	.....
Cienfuegos, Cuba	25	5:53 p. m.	6:45 p. m.	1.15	5:54 p. m.	6:13 p. m.	T.	0.37	0.63	0.83	1.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Havana, Cuba	11	6:10 p. m.	7:25 p. m.	0.79	6:21 p. m.	6:45 p. m.	T.	0.30	0.52	0.65	0.72	0.77	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	28	3:40 p. m.	6:10 p. m.	0.93	4:07 p. m.	4:35 p. m.	T.	0.28	0.55	0.67	0.73	0.84	0.88	.....	.....	.....	.....	.....	.....	.....	.....
Puerto Principe, Cuba	17	3:27 p. m.	5:12 p. m.	0.98	3:45 p. m.	4:15 p. m.	0.06	0.21	0.37	0.51	0.62	0.74	0.81	0.85	.....	.....	.....	.....	.....	.....	.....
San Juan, Porto Rico	14	12:01 p. m.	7:20 p. m.	1.19	12:02 p. m.	12:27 p. m.	T.	0.16	0.38	0.50	0.58	0.70	.....	.....	.....	.....	.....	.....	.....	.....	.....
Santo Domingo, W. I	16	11:42 a. m.	6:29 p. m.	2.08	11:58 a. m.	12:19 p. m.	T.	0.49	0.81	1.24	1.51	1.58	1.59	.....	.....	.....	.....	.....	.....	.....	.....

* Self-register not working. † No precipitation during the month.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, July, 1903.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.67	29.81	—.16	54.1	— 5.2	61.6	46.7	3.48	—0.41	.....
Sydney, C. B. I	29.81	29.85	—.08	61.1	— 1.2	70.3	52.0	2.78	—0.87	.....
Halifax, N. S	29.75	29.85	—.11	61.9	— 1.5	69.7	54.1	4.32	+0.27	.....
Grand Manan, N. B	29.77	29.82	—.11	61.3	— 0.4	69.4	53.1	3.87	+0.87	.....
Yarmouth, N. S	29.80	29.87	—.08	60.3	+ 0.8	66.8	53.8	3.56	—0.06	.....
Charlottetown, P. E. I	29.77	29.81	—.09	65.0	+ 0.9	74.0	56.0	3.22	—0.27	.....
Chatham, N. B	29.76	29.78	—.10	63.7	— 1.3	73.8	53.5	5.57	+1.38	.....
Father Point, Que	29.78	29.80	—.05	54.9	— 2.7	61.8	48.0	4.40	+1.36	.....
Quebec, Que	29.52	29.83	—.08	64.6	— 0.9	73.1	56.0	5.09	+0.83	.....
Montreal, Que	29.65	29.85	—.08	68.2	— 0.3	75.5	60.9	2.87	—1.42	.....
Bissett, Ont	29.31	29.91	—.03	64.5	— 1.1	76.5	52.5	4.17	+1.05	.....
Ottawa, Ont	29.54	29.85	—.09	68.5	— 1.0	76.7	60.3	3.24	—0.23	.....
Kingston, Ont	29.58	29.88	—.09	67.0	— 1.2	74.3	59.6	4.01	+1.12	.....
Toronto, Ont	29.55	29.91	—.06	69.1	+ 1.1	79.1	59.2	4.41	+1.49	.....
White River, Ont	28.64	29.93	—.01	60.5	+ 1.0	73.8	47.2	3.21	+0.41	.....
Port Stanley, Ont	29.33	29.96	—.02	67.7	— 0.1	77.0	58.0	8.10	+5.06	.....
Saugeen, Ont	29.26	29.96	—.01	66.9	+ 2.2	74.6	59.2	2.23	+0.25	.....
Parry Sound, Ont	29.23	29.91	—.05	65.9	— 0.1	75.2	56.6	2.89	+0.27	.....
Port Arthur, Ont	29.22	29.93	—.01	61.8	— 0.2	72.2	51.5	3.29	—0.19	.....
Winnipeg, Man	29.08	29.89	—.04	65.4	— 0.6	77.8	52.9	3.05	—0.03	.....
Minnedosa, Man	28.14	29.92	—.01	62.1	— 0.1	73.3	50.9	3.40	+0.80	.....
Qu'Appelle, Assin	27.69	29.91	—.01	60.6	— 2.9	71.7	49.4	4.26	+1.78	.....
Medicine Hat, Assin	27.66	29.90	.00	65.4	— 2.4	78.5	52.4	1.39	—0.70	.....
Swift Current, Assin	27.40	29.93	+.02	62.6	— 3.9	74.3	50.9	4.11	+1.67	.....
Calgary, Alberta	26.44	29.92	+.02	56.8	— 3.8	69.1	44.5	4.10	+1.42	.....
Banff, Alberta	25.43	29.97	+.07	53.5	— 3.1	65.6	41.4	5.70	+2.46	.....
Edmonton, Alberta	27.66	29.92	+.02	59.2	— 1.4	70.1	48.4	3.45	+0.42	.....
Prince Albert, Sask	28.35	29.89	—.02	58.9	— 3.0	70.3	47.5	2.96	+0.91	.....
Battleford, Sask	28.22	29.94	+.04	60.8	— 3.9	71.4	50.1	2.50	—0.16	.....
Kamloops, B. C	28.71	29.90	—.04	67.3	— 1.2	79.8	54.9	2.33	+0.72	.....
Victoria, B. C	29.97	30.06	+.01	58.2	— 1.8	64.5	51.9	0.46	+0.06	.....
Barkerville, B. C	25.74	30.02	+.11	52.3	— 2.8	64.8	39.7	3.77	+0.75	.....
Hamilton, Bermuda	29.97	30.13	—.01	78.7	+ 0.3	84.7	72.6	1.73	—2.71	.....
Dawson City, Yukon	.....	.....	.....	60.4	.....	73.3	47.5	1.11	.....	.....

TABLE VII.—*Heights of rivers referred to zeros of gages, July, 1903.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	7.7	13	3.2	1,2	6.0	4.5
Red Wing, Minn	1,914	14	7.7	10	3.0	1	5.8	4.7
Reeds Landing, Minn.	1,884	12	7.3	10	2.9	1,2	5.4	4.4
La Crosse, Wis	1,819	12	9.4	12,13	4.2	1,3	7.0	5.2
Prairie du Chien, Wis	1,759	18	10.4	18	4.0	1-3	7.5	6.4
Dubuque, Iowa	1,699	15	13.2	19	4.8	2,5	8.5	8.4
Leclaire, Iowa	1,609	10	8.1	21	3.2	3	5.8	4.9
Davenport, Iowa	1,593	15	10.4	21,22	4.2	2,3,8	7.4	6.2
Muscatine, Iowa	1,562	16	12.5	22	5.3	3,8,9	8.9	7.2
Galland, Iowa	1,472	8	6.0	23-26	2.6	4-6,10,11	4.4	3.4
Keokuk, Iowa	1,463	15	11.0	24,25	4.8	4,10,11	8.0	6.2
Hannibal, Mo.	1,402	13	12.2	26	6.3	11,12	9.3	5.9
Grafton, Ill.	1,306	23	13.4	27	8.6	12,13	11.1	4.8
St. Louis, Mo	1,264	30	21.1	1	15.8	14	18.5	5.3
Chester, Ill	1,189	30	17.6	1,2	13.7	14,15	15.6	3.9
New Madrid, Mo.	1,003	34	20.6	1	16.6	16,17	18.1	4.0
Memphis, Tenn	843	33	20.7	1	13.4	19	15.3	7.3
Helena, Ark.	767	42	30.9	1	19.5	20	22.4	11.4
Arkansas City, Ark.	635	42	41.6	1	22.3	21,22	27.8	19.3
Greenville, Miss.	595	42	36.2	1	18.2	22	23.3	18.0
Vicksburg, Miss.	474	45	42.5	1	21.4	24,31	29.1	21.1
Natchez, Miss.[1]	373	46	40.0	6	22.1	31	28.5	17.9
Baton Rouge, La.	240	35	30.5	1,3	14.8	31	22.7	15.7
Donaldsonville, La	188	28	24.1	2,3	10.8	31	17.5	13.3
New Orleans, La.	108	16	15.4	3	7.4	31	11.5	8.0
Yellowstone River.								
Glendive, Mont.	98	17	8.9	3	4.3	31	5.8	4.6
James River.								
Lamoure, N. Dak.	.....	25	0.0	3-18	— 0.3	30,31	—0.1	0.3
Huron, S. Dak	210	9	1.8	4,5	0.6	26	1.0	1.2
Missouri River.								
Townsend, Mont.	2,504	10	5.2	8,9	3.9	31	4.5	1.3
Fort Benton, Mont.	2,285	12	4.2	5	1.2	30	2.7	3.0
Bismarck, N. Dak.	1,309	14	9.0	6	4.7	31	6.7	4.3
Pierre, S. Dak.	1,114	14	9.0	8	5.7	25	7.1	3.3
Sioux City, Iowa	784	19	13.2	10,11	10.2	28,29	11.5	3.0
Omaha, Nebr.	669	18	12.6	12	10.3	29,30	11.3	2.3
Plattsmouth, Nebr.	641	17	8.8	12	5.9	30	7.5	2.9
St. Joseph, Mo.	481	10	10.4	13,14	6.6	30,31	8.9	3.8
Kansas City, Mo.	388	21	17.0	1	11.9	31	15.0	5.1
Boonville, Mo.	199	20	15.0	1	11.1	31	13.6	3.9
Hermann, Mo.	103	24	15.3	1	10.8	31	13.2	4.5
Chippewa River.								
Chippewa Falls, Wis.	90	16	10.5	5,6	1.0	26,27,30,31	4.5	9.5
Illinois River.								
Peoria, Ill.	135	14	9.7	1,2	8.5	29,31	8.9	1.2
Youghiogheny River.								
Confluence, Pa.	59	10	5.8	6	1.0	31	3.4	4.8
West Newton, Pa.	15	23	9.1	6	0.6	31	2.8	8.5
Allegheny River.								
Warren, Pa.	177	14	2.4	24	0.3	18	1.2	2.1
Oil City, Pa	123	13	3.6	19	0.9	17,18	1.9	2.7
Parker, Pa.	73	20	4.6	19	1.0	17	2.2	3.6
Freeport, Pa	29	20	9.0	6,21	2.7	17	4.9	6.3
Clarion River.								
Clarion, Pa.	32	10	5.4	19	0.6	17	2.0	4.8
Monongahela River.								
Weston, W. Va.	161	18	0.2	1	— 1.1	26-29	0.5	1.3
Fairmont, W. Va.	119	25	3.9	1	1.0	30,31	1.8	2.9
Greensboro, Pa.	81	18	10.6	1	6.9	30,31	8.2	3.7
Lock No. 4, Pa.	40	28	12.8	1	6.0	28	8.1	6.8
Conemaugh River.								
Johnstown, Pa.	64	7	6.5	6	2.0	30,31	3.0	4.5
Red Bank Creek.								
Brookville, Pa.	35	8	2.0	6,21	0.2	17	0.9	1.8
Beaver River.								
Ellwood Junction, Pa.	10	14	5.0	1	2.5	14-18	3.7	2.5
Great Kanawha, River.								
Charleston, W. Va.	58	30	8.0	15	4.0	5	6.3	4.0
Little Kanawha River.								
Glenville, W. Va	103	20	2.5	31	— 2.9	29	—1.7	5.4
New River.								
Radford, Va	155	14	2.0	14	— 0.2	22,24,29,30	0.3	2.2
Hinton, W. Va.	95	14	4.1	14	1.4	27-29	2.2	2.7
Cheat River.								
Rowlesburg, W. Va.	36	14	4.0	1	2.0	29,30	2.8	2.0
Ohio River.								
Pittsburg, Pa.	966	22	8.5	7	2.9	11,12	5.2	5.6
Davis Island Dam, Pa.	960	25	9.6	7	3.5	30,31	6.3	6.1
Beaver Dam, Pa	925	27	13.2	1	4.2	30	8.1	9.0
Wheeling, W. Va.	875	36	12.7	1	3.9	31	7.8	8.8
Parkersburg, W. Va.	785	36	11.5	2	5.4	31	8.1	6.1
Point Pleasant, W. Va.	705	39	12.2	2	3.9	31	7.5	8.3
Huntington, W. Va.	660	50	15.3	4	7.3	31	11.1	8.0
Catlettsburg, Ky.	651	50	14.6	4	5.5	31	10.0	9.1
Portsmouth, Ohio	612	50	15.3	4	7.2	31	11.1	8.1
Cincinnati, Ohio.	499	50	17.1	1	9.3	24	12.7	7.8
Madison, Ind	413	46	15.0	1	8.8	25	11.4	6.2
Louisville, Ky	367	28	8.1	1	5.6	18,19,25,26	6.5	2.5
Evansville, Ind	184	35	12.4	4	7.3	28,29	9.6	5.1
Paducah, Ky.	47	40	10.8	5	7.4	31	9.3	3.4
Cairo, Ill.	1,073	45	24.0	1	19.8	16	21.5	4.2
Muskingum River.								
Zanesville, Ohio	70	20	6.3	1,11	5.5	29-31	5.8	0.8
Scioto River.								
Columbus, Ohio.	110	17	3.9	13	2.4	29-31	3.3	1.5
Miami River.								
Dayton, Ohio	77	18	1.5	1,12,13	0.9	10	1.1	0.6
Wabash River.								
Mount Carmel, Ill.	50	15	6.2	8	1.7	31	3.1	4.5
Licking River.								
Falmouth, Ky.	30	25	2.5	23	0.5	31	1.4	2.0

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Kentucky River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
High Bridge, Ky.	117	17	9.7	23,24	9.0	20,21,29	9.3	0.7
Frankfort, Ky.	65	31	6.3	24,25	5.4	21,31	5.9	0.9
Clinch River.								
Speers Ferry, Va.	156	20	1.0	14	— 0.8	27,28,30	—0.3	1.8
Clinton, Tenn.	52	25	6.0	20	3.0	31	4.2	3.0
Holston River.								
Bluff City, Tenn.	170	15	2.8	13	0.4	{3, 10, 11, 25-31}	0.7	2.4
Rogersville, Tenn.	103	14	4.2	14	1.5	28-31	1.9	2.7
French Broad River.								
Asheville, N. C.	144	6	1.5	12	— 0.2	26-28	0.4	1.7
Leadvale, Tenn.	70	15	2.0	13	— 0.6	28,29	0.3	2.6
Hiwassee River.								
Charleston, Tenn	18	22	6.7	14	1.4	27-29	2.3	5.3
Tennessee River.								
Knoxville, Tenn.	635	29	4.3	15	0.8	28-30	1.8	3.5
Kingston, Tenn.	556	25	3.5	16	1.1	29,30	2.2	2.4
Chattanooga, Tenn.	452	33	5.7	14	2.2	31	3.8	3.5
Bridgeport, Ala.	402	24	4.0	15	1.0	31	2.3	3.0
Florence, Ala.	255	16	3.5	17-19	0.9	30,31	2.3	2.6
Riverton, Ala.	225	25	4.1	17	0.6	30	2.5	3.5
Johnsonville, Tenn.	95	24	5.1	19	2.4	31	4.0	2.7
Cumberland River.								
Burnside, Ky.	516	50	3.0	20	1.3	16	2.0	1.7
Carthage, Tenn.	305	40	3.1	14,20	1.4	31	2.4	1.7
Nashville, Tenn	189	40	6.1	14	2.4	31	4.0	3.7
Clarksville, Tenn.	126	42	7.8	15	4.1	31	5.7	3.7
Arkansas River.								
Wichita, Kans.	832	10	3.6	1	1.1	30	2.0	2.5
Webbers Falls, Ind. T.	465	23	9.1	5	3.5	31	5.7	5.6
Fort Smith, Ark.	403	22	13.9	6	2.9	31	6.4	11.0
Dardanelle, Ark.	256	21	13.7	7	2.9	31	6.6	10.8
Little Rock, Ark.	176	23	14.5	8	5.0	30	8.2	9.5
White River.								
Newport, Ark.	150	26	5.6	1	3.1	30,31	4.0	2.5
Yazoo River.								
Yazoo City, Miss.	80	25	16.9	1	— 0.5	31	6.2	17.4
Red River.								
Arthur City, Tex.	638	27	28.8	5	5.8	28	11.6	23.0
Fulton, Ark.	515	28	28.0	10,11	8.7	28,29	16.5	19.3
Shreveport, La.	327	29	15.0	12-15	3.5	1,6	9.7	11.5
Alexandria, La.	118	33	17.1	16-18	5.4	2	11.5	11.7
Ouachita River.								
Camden, Ark.	304	39	7.9	1	4.9	23-25	5.7	3.0
Monroe, La.	122	40	12.8	13-15	3.1	31	9.9	9.7
Atchafalaya River.								
Melville, La.	100	31	31.9	1-5	22.3	31	28.0	9.6
Passaic River.								
Chatham, N. J	69	.....	4.2	1	2.3	18	2.9	1.9
Pompton River.								
Pompton Plains, N. J	6	.....	5.7	1	3.9	18	4.6	1.8
Susquehanna River.								
Binghamton, N. Y.	306	16	5.8	24	2.9	14-18	3.3	2.9
Towanda, Pa.	262	16	5.2	6	0.8	16-18	1.7	4.4
Wilkesbarre, Pa.	183	17	8.8	7	3.4	18	4.9	5.4
Harrisburg, Pa	69	17	7.3	1	2.3	18	4.0	5.0
West Branch Susquehanna.								
Lockhaven, Pa	65	12	3.2	20	0.3	17	1.4	2.9
Williamsport, Pa	39	20	8.0	20	2.0	17,18	3.8	6.0
Juniata River.								
Huntingdon, Pa.	90	24	9.4	19	3.3	31	4.3	6.1
Shenandoah River.								
Riverton, Va	58	22	2.0	1,2	— 0.3	16-23,28-31	0.2	2.3
Potomac River.								
Cumberland, Md.	290	8	8.0	6	2.6	31	3.6	5.4
Harpers Ferry, W. Va.	172	18	10.4	7	0.6	30,31	3.7	9.8
James River.								
Lynchburg, Va	260	18	3.6	14	0.4	29,30	1.6	3.2
Richmond, Va.	111	12	2.4	1	— 0.3	22	0.4	2.7
Dan River.								
Danville, Va	55	8	2.4	14	0.0	29-21	0.5	3.4
Roanoke River.								
Clarksville, Va	196	12	8.0	14	3.2	27	4.2	4.8
Weldon, N. C.	129	30	22.5	15	9.0	22,29	11.3	13.5
Cape Fear River.								
Fayetteville, N. C	112	38	17.2	7	1.4	30	5.1	15.8
Edisto River.								
Edisto, S. C	75	6	5.3	14-16	2.5	31	4.3	2.8
Pedee River.								
Cheraw, S. C.	149	27	8.6	7	1.8	28,31	3.5	6.8
Black River.								
Kingstree, S. C.	52	12	8.9	31	2.8	31	5.6	6.1
Lynch Creek.								
Effingham, S. C.	35	12	8.0	4	3.0	30,31	5.5	5.0
Santee River.								
St. Stephens, S. C.	97	12	8.1	1-3	2.5	31	6.5	5.6
Congaree River.								
Columbia, S. C.	37	15	3.8	14	0.8	30,31	2.1	3.0
Waleree River.								
Camden, S. C.	45	24	15.0	14	6.9	30	9.0	5.1
Waccamaw River.								
Conway, S. C.	40	7	2.9	15	1.8	31	2.5	1.1
Savannah River.								
Calhoun Falls, S. C.	347	15	4.8	7	2.8	28,29	3.5	2.0
Augusta, Ga.	268	32	14.3	15	7.6	29	9.2	6.7
Broad River.								
Carlton, Ga.	30	11	5.5	13	2.3	28	2.9	3.2
Flint River.								
Albany, Ga.	80	20	9.1	13	2.7	31	5.4	6.4
Chattahoochee River.								
Oakdale, Ga.	305	18	8.0	13	1.8	28	3.6	6.2
Westpoint, Ga	239	20	6.4	14	2.7	28,29	3.7	3.7
Ocmulgee River.								
Macon, Ga.	125	18	11.0	15	3.2	28,30	4.9	7.8

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ocmulgee River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Abbeville, Ga.	50	11	9.6	14	2.8	30, 31	6.2	6.8
Oconee River.								
Dublin, Ga	79	20	7.3	17	0.5	29, 30	3.1	6.8
Chosa River.								
Rome, Ga.	271	30	11.1	14	1.8	29	3.2	9.3
Gadsden, Ga.	144	18	8.6	15	1.0	30	2.8	7.6
Alabama River.								
Montgomery, Ala.	265	35	7.7	17	2.5	30, 31	4.8	5.2
Selma, Ala	212	35	10.0	1	3.5	26, 30, 31	6.4	6.5
Tombigbee River.								
Columbus, Miss	303	33	0.0	1	— 3.1	29-31	—2.2	3.1
Demopolis, Ala.	155	35	6.5	1	— 1.1	30	1.8	7.6
Black Warrior River.								
Tuscaloosa, Ala.	90	45	6.7	14	4.6	28	5.7	2.1
Sabine River.								
Logansport, La.	.....	.....	17.9	24, 25	4.0	31	12.9	13.9
Orange, Tex.	.....	7	2.2	4	0.5	21	1.0	1.7
Neches River.								
Rockland, Tex	.....	20	7.3	7	0.3	27	2.4	7.0
Beaumont, Tex	.....	.....	.....	.....	.....	.....	.....	.....
Trinity River.								
Dallas, Tex.	330	25	32.7	6	2.8	29	9.4	29.9

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Trinity River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Riverside, Tex.	.....	40	17.3	23	2.6	29, 30	12.2	14.7
Liberty, Tex	.....	.....	.....	.....	.....	.....	.....	.....
Brazos River.								
Kopperl, Tex	369	21	1.6	31	0.0	7-29	0.2	1.6
Waco, Tex.	301	24	9.9	5	2.6	26-29	4.0	7.3
Hempstead, Tex	.....	40	16.0	7	2.0	28	6.2	14.0
Booth, Tex	76	39	10.7	9	2.3	26	5.8	8.4
Colorado River.								
Ballinger, Tex	.....	21	2.0	1	1.3	20, 21	1.6	0.7
Austin, Tex.	214	18	6.6	31	1.3	24, 25	2.3	5.3
Columbus, Tex.	.....	.....	32.9	31	7.2	27	11.2	25.7
Red River of the North.								
Moorhead, Minn	418	26	8.0	6-8	7.3	30, 31	7.6	0.7
Columbia River.								
Umatilla, Oreg.	270	25	21.2	1	11.9	31	15.8	9.3
The Dalles, Oreg.	166	40	36.6	1	18.5	31	25.9	18.1
Willamette River.								
Albany, Oreg	118	20	2.5	1	1.4	26-31	1.9	1.1
Portland, Oreg.	12	15	21.0	1	9.2	31	14.5	11.8
Sacramento River.								
Red Bluff, Cal.	265	23	0.4	1-9	0.2	23-31	0.3	0.2
Sacramento, Cal.	64	29	11.7	1, 2	8.2	30, 31	9.5	3.5

(1) 26 days only.

HAWAIIAN CLIMATOLOGICAL DATA.

By R. C. LYDECKER, Acting Territorial Meteorologist.

Rainfall data for July, 1903.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	20.13
Hilo (town)	100	.....
Kaumana	1,250	32.79
Pepeekeo	100	16.82
Hakalau	200	19.63
Honohina	300	18.54
Puuohua	1,050	38.20
Laupahoehoe	500	27.26
Ookala	400	10.60
HAMAKUA, ne.		
Kukaiau	250	12.73
Paauilo	300	9.37
Paauhau	300	5.34
Honokaa (Mill)	425	6.20
Honokaa (Meinicke)	1,100	8.71
Kukuihaele	700	7.90
KOHALA, n.		
Awini Ranch	1,100	18.36
Niulii	200	7.34
Kohala (Mission)	521	6.85
Kohala (Sugar Co.)	270	7.72
Hawi, Mill	700	7.22
Puakea Ranch	600	5.31
Puuhue Ranch	1,847	6.01
Waimea	2,720	5.20
KONA, w.		
Huehue	2,000	3.64
Holualoa	1,350	8.40
Kaukahoku Leheula.	3,500	6.36
Kainaliu	1,470	10.08
Kealakekua	1,580	9.60
Napoopoo	25	2.56
Hoopuloa	1,650	.....
Hoopuloa	2,300	.....
Puuwaawaa Ranch	2,700	3.27
Huehue	2,000	.....
KAU, se.		
Kahuku Ranch	1,680	3.81
Honuapo	15	3.81
Naalehu	650	6.06
Hilea	310	4.40
Pahala	850	2.53
Moaula	1,700	.....
Volcano House	4,000	11.82
PUNA, e.		
Olaa, Mountain View (Russel)	1,690	35.55
Olaa (Plantation)	.....	.....
Kapoho	110	9.54
Pahoa	600	20.15
MAUI.		
Lahaina	40	.....
Waiopae Ranch	700	1.71
Kaupo (Mokulau), s.	285	9.35
Kipahulu, s	308	9.72
Nahiku, ne	850	29.30
Nahiku	1,600	.....
Haiku, n.	700	9.58
Kula (Waiakoa), n.	2,700	0.55
Kula (Erehwon), n.	4,000	.....

Stations.	Elevation.	Amount.
MAUI—Cont'd.	*Feet.*	*Inches.*
Puuomalei, n.	1,400	6.86
Paia	180	4.84
Haleakala Ranch.	2,000	2.18
Wailuku, ne.	250	1.22
OAHU.		
Punahou (W. B.), sw.	47	2.08
Kulaokahua (Castle), sw.	50	1.06
Makiki Reservoir	120	1.94
U. S. Naval Station, sw.	6	0.76
Kapiolani Park, sw.	10	0.87
College Hills.	175	3.16
Manoa (Woodlawn Dairy), c.	285	7.96
Manoa (Rhodes Gardens)	360	12.03
School street (Bishop), sw.	.....	.....
Insane Asylum, sw.	30	2.05
Kamehameha School.	.....	.....
Kalihi-Uka, sw.	485	.....
Nuuanu (W. W. Hall), sw.	50	2.66
Nuuanu (Wyllie street)	250	.....
Nuuanu (Elec. Station), sw.	405	4.94
Nuuanu (Luakaha), e.	850	15.35
U. S. Experiment Station	350	3.39
Laniakea (Nahuina)	1,150	8.98
Tantalus Heights.	1,360	11.07
Waimanalo, ne.	25	2.37
Maunawili, ne.	300	6.92
Kaneohe	100	3.03
Ahuimanu, ne.	350	7.42
Kahuku, n	25	1.36
Waialua	37	.....
Wahiawa.	900	3.23
Ewa Plantation, s.	60	0.00
U. S. Magnetic Station	45	0.12
Waipahu	200	0.00
Moanalua	15	1.45
Pacific Heights.	700	.....
KAUAI.		
Lihue (Grove Farm), e.	200	1.91
Lihue (Molokoa), e.	300	2.85
Lihue (Kukaua), e.	1,000	6.72
Kealia, e.	15	0.74
Kilauea, ne.	325	4.11
Hanalei, n.	10	7.48
Waioli	15	.....
Haena	15	.....
Waiawa	32	0.06
Eleele	.....	.....
Wahiawa (Mountain)	.....	.....
McBryde (Residence)	850	3.73
Lawai (Gov. Road)	450	4.21
Lawai, w.	225	1.10
Lawai, e.	450	4.21
Koloa	100	1.11
Delayed June reports.		
U. S. Magnetic Station	.....	0.22
Nuuanu (Electric Station)	.....	3.44
Paia	.....	2.42
Pahala	.....	1.21

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is $10^h\ 30^m$ slow of Greenwich time. Honolulu local mean time is $10^h\ 31^m$ slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, July, 1903.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.								
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		Total rainfall at 9 a. m., local time.
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		≋				
1	30.01	75	69	83	73	65.5	68	ne.	2–4	3–6	30.05	29.95	0.01
2	30.00	75	71	84	73	64.5	69	ne.	2	2–4	30.04	29.97	0.03
3	29.95	75	70	84	72	68.3	74	ne.	3–0	4-2	30.05	29.95	0.05
4	29.95	75	69	84	74	66.0	69	ne.	1-3	2	30.00	29.91	0.00
5	29.96	76	69	84	73	66.7	69	ne.	3-0	4	30.00	29.91	0.00
6	29.97	75	68	85	74	65.7	66	ne.	1-3	3	30.01	29.95	0.00
7	29.93	75	68	84	73	63.3	63	ne.	2	1-4	30.00	29.91	0.00
8	29.95	75	70	85	72	65.3	66	ne.	1-3	1-4	29.98	29.91	0.12
9	29.96	76	68.5	81	72	66.7	72	ne.	4	3-4	30.00	29.93	0.17
10	29.98	75	67	83	73	64.7	66	ne.	3-5	2-5	30.02	29.96	0.14
11	29.98	75	67	81	73	64.3	68	ne.	3-5	10-4	30.03	29.96	0.03
12	30.00	75	67	82	73	62.7	64	ne.	4-2	2	30.04	29.96	0.00
13	30.01	74	68	83	73	64.0	66	ne.	2-3	1	30.06	29.99	0.05
14	30.00	74	69	82	72	63.7	66	ne.	3-1	3-0	30.04	29.97	0.08
15	29.98	75	68	83	70	65.7	72	ne.	1-3	4	30.05	29.95	0.03
16	29.97	75	66	82	72	63.3	65	ne.	3-5	1-4	30.01	29.94	0.00
17	29.99	74	67	84	74	62.0	63	ne.	4-5	3	30.04	29.97	0.00
18	30.01	75	67.5	83	73	64.3	67	ne.	4-2	1-3	30.06	26.97	0.01
19	29.97	75	70.5	83	73	64.5	65	ne.	3	1-3	30.04	29.94	0.02
20	29.96	76	70	85	73	63.0	71	ne.	3-1	1-4	30.02	29.94	0.05
21	29.96	77	71	87	70	68.0	71	ne.	1-3	1-3	30.02	39.95	0.01
22	30.00	78	70.5	85	75	67.5	68	ne.	1-3	2-0	30.04	29.96	0.03
23	30.05	77	68	85	76	66.5	66	ne.	3-5	2	30.09	30.00	T.
24	30.04	74	69	83	75	63.0	61	nne.	4-5	1-7	30.09	30.01	0.22
25	30.02	74	69	81	72	66.7	72	ne.	5	3-5	30.08	30.01	0.16
26	30.06	75	66.5	80	71	63.3	70	ne.	3-5	4	30.10	30.01	0.11
27	30.06	75	67.5	82	71	62.5	64	nne.	5	2-4	30.09	30.03	0.12
28	30.01	75	67	82	71	63.5	65	ne.	5-3	1-4	30.09	30.01	T.
29	29.97	75	67	81	74	63.0	64	ne.	4	9-2	30.06	29.97	0.04
30	29.96	72	69.5	84	73	65.0	66	ne.	4	3	30.02	29.96	0.53
31	29.98	74	70	80	70	67.5	62	ne.	2	10–7	30.05	29.95	0.05
Sums.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.06
Means.	29.988	75.0	68.5	83.1	72.7	64.9	67.7	.....	3.1	3.2	30.041	29.961	.....
Departure.	+.004	.....	.....	.....	.....	—0.1	—0.8	.....	.....	—0.8	.....	.....	+0.34

Mean temperature for the month of July, 1903, $(6+2+9)+3=77.6°$; normal is 77.2°.
Mean pressure for the month of July, 1903, $(9+3)+2=30.000$; normal is 29.996.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of $(6+9+2+9)+4$. ≋ Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

Mean temperature table for July, 1903.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.
	Feet.	°	°	°
Pepeekeo	100	77.8	70.8	73.6
Kohala	521	78.9	67.7	72.6
Waimea	2,730	71.9	61.5	66.9
Volcano house	4,000	70.5	54.5	68.1
Waikiki	15	83.0	73.8	77.7
United States Magnetic Station	50	87.5	70.3	78.2
W. R. Castle	50	83.9	74.1	78.3
United States Experimental Station	350	83.6	71.2	76.7

GENERAL SUMMARY FOR JULY, 1903.

Honolulu.—Temperature mean for the month, 77.6°; normal, 77.2°; average daily maximum, 83.1°; average daily minimum, 72.7°; mean daily range, 10.4°; greatest daily range, 13°; least daily range, 7°; highest temperature, 87° (this is 1 degree less than the highest on record at the Weather Bureau); lowest temperature, 70°.

Barometer average, 30.00; normal, 29.996; highest, 30.10; lowest, 29.91; greatest 24-hour change, that is from any given hour on one day to the same hour on the next, .06; lows passed this point, 3d, 4th, 6th, and 7th; highs, 22d to 28th, inclusive.

Relative humidity average, 67.7 per cent; normal, 68.5 per cent; mean dew-point, 64.9°; normal, 65°; mean absolute moisture, 6.73 grains per cubic foot; normal, 6.81 grains.

Rainfall, 2.06 inches; normal, 1.72 inches; rain record days, 22; normal, 19; greatest rainfall in one day, 0.53, on the 30th; total at Luakaha, 15.35; normal, 9.15; at Kapiolani Park, 0.87; normal, 0.17.

The artesian well water level fell during the month from 34.18 feet above mean sea level to 33.80; July 31, 1902, it stood at 33.40. The average daily mean sea level for the month was 9.77 feet, the assumed annual mean being 10.00 feet above datum; for July, 1902, it was 9.86.

Trade wind days, 30, (two of nne.); normal, 29; average force of wind during daylight, Beaufort scale, 3.1; average cloudiness, tenths of sky, 3.2; normal, 4.0.

Approximate percentages of district rainfall as compared with normal: Hilo, 244 per cent; Hamakua, 143; excepting Kukaiau, which was 315; Kohala, 190; Waimea, 209; Kona, 124; Kau, variable, from 254 to 438; Puna, 254; all on the Island of Hawaii. Maui, 235; Oahu, 134, excepting Kapiolani Park, which was 500 per cent; Kauai, 119, except Waiawa, 18. The heaviest 24-hour rainfalls for the month were at Puuohua, 7.70; Waiakea, 4.90; Naalehu, 4.33; all on Hawaii. The heaviest monthly rainfall thus far reported was at Puuohua, 38.20 inches; probably there was a greater fall at Nahiku, Maui (1600 feet elevation), but that station has not yet reported. It will be seen from the above that the precipitation throughout the group was greatly in excess of the July normal, especially so on the Islands of Hawaii and Maui, which had the heaviest July rainfall since 1890; while the percentages for Oahu and Kauai were not as great, the rainfall on these two islands was the heaviest, with one exception (1900), July record for thirteen years.

United States Magnetic Station, dew-point, 63.5°; relative humidity, 65.2 per cent.

Kohala, dew-point, 67.7°; relative humidity, 82.7 per cent.

The Borrelly comet was reported as having been seen here for the first time on the evening of the 22d. Lightning at Honolulu on the evening of the 19th. The rainfall at Honolulu during the early morning of the 30th, was accompanied by several peals of thunder.

Waimea, Hawaii, reports fresh and strong northeast and easterly winds all the month, with gale on the 26th and 27th. Light snow on Mauna Kea.

Volcano House reports extraordinary rainfall the last seven days of the month. Kohala reports earthquake at 1 p. m., on the 1st; thunder and lightning with rain on the 19th, 4 inches falling at Kahuwa; trade winds throughout the month. Pepeekeo, rain every day, gulches full of water all the time, hot and sultry days, long earthquake shock July 2, at 12:30 p. m.; winds mostly east and east-northeast; extra fine afterglow on the morning of the 20th. Heavy surf 7th to 11th, inclusive, and 22d to 30th.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during July, 1903.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1903.	Normal, 1889–1900.	Observed, 1903.	Normal, 1889–1900.	Observed, 1903.	Normal, 1889–1900.	Observed, 1903.	Normal, 1889–1900.	Duration, 1903.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.15	26.14	63.9	64.0	89	91	.....	0.04	.....
2 a. m	26.12	26.12	63.7	63.7	88	91	.....	0.05	.....
3 a. m	26.12	26.11	63.1	63.1	88	91	.....	0.10	.....
4 a. m	26.11	26.11	62.3	62.8	91	91	.....	0.05	.....
5 a. m	26.11	26.10	61.7	62.8	91	91	.....	0.02	.....
6 a. m	26.11	26.11	61.5	62.6	90	91	.....	0.02	.....
7 a. m	26.13	26.12	62.2	63.0	88	90	.....	0.02	.....
8 a. m	26.13	26.13	62.2	66.4	79	85	.....	0.03	.....
9 a. m	26.15	26.14	69.6	69.3	72	77	.....	0.05	.....
10 a. m	26.16	26.15	72.9	72.1	70	73	.....	0.03	.....
11 a. m	26.16	26.14	74.5	74.0	65	70	0.09	0.06	0.50
Noon	26.14	26.13	75.3	75.0	65	69	0.08	0.19	0.66
1 p. m	26.13	26.13	76.1	75.6	67	69	0.70	0.58	2.63
2 p. m	26.13	26.11	74.8	75.1	69	70	0.89	0.75	4.17
3 p. m	26.10	26.09	74.1	73.6	70	75	1.84	0.93	5.09
4 p. m	26.09	26.09	72.8	71.8	75	77	0.89	1.45	6.33
5 p. m	26.09	26.09	70.5	69.9	79	82	1.09	1.37	5.00
6 p. m	26.10	26.10	69.1	68.4	81	84	1.17	1.49	6.42
7 p. m	26.11	26.11	67.6	66.9	85	88	0.92	0.82	5.00
8 p. m	26.13	26.13	66.6	65.9	85	89	0.30	0.70	3.66
9 p. m	26.15	26.15	66.0	65.5	86	89	0.17	0.34	3.17
10 p. m	26.15	26.15	65.2	64.9	88	90	0.15	0.22	2.00
11 p. m	26.16	26.16	64.5	64.6	89	90	0.09	0.11	1.50
Midnight	26.16	26.15	64.2	64.2	87	91	0.01	0.07	0.83
Mean	26.13	26.13	67.7	67.7	81	84	.....	.....	.....
Minimum	26.08	25.98	57.2	55.8	46	.....	.....	.....	.....
Maximum	26.22	26.24	84.7	84.6	100	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	8.39	9.49	46.96

REMARKS.—At San José the barometer is 1169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, July, 1903.*

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1903.	Normal, 1889–1900.	Observed, 1903.	Normal, 1889–1900.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	10.50	8.18	56	65	69.5	70.3	71.4	71.5	71.3
8 a. m	19.81	15.97	.....	.....	.....	.....	.....	.....	.....
9 a. m	21.30	17.33	.....	.....	.....	.....	.....	.....	.....
10 a. m	19.34	16.33	76	71	69.7	70.3	71.4	71.6	.....
11 a. m	14.77	14.94	.....	.....	.....	.....	.....	.....	.....
Noon	11.54	10.32	.....	.....	.....	.....	.....	.....	.....
1 p. m	10.20	9.65	89	82	70.4	70.4	71.4	71.5	....
2 p. m	15.24	8.84	.....	.....	.....	.....	.....	.....	.....
3 p. m	11.14	7.58	.....	.....	.....	.....	.....	....	.....
4 p. m	6.78	5.17	95	92	71.0	70.7	71.4	71.5	....
5 p. m	3.58	3.19	.....	.....	.....	.....	.....	.....	.....
6 p. m	1.89	1.02	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	85	89	70.9	70.8	71.4	71.5	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	66	79	70.6	70.8	71.5	71.5	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	79	80	70.3	70.6	71.4	71.5	71.3
Total	144.09	118.52	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, July, 1903.*

Stations.	Height above sea level.	Observed, 1903.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	60	*	*	3	13.35	22
Boca Banano	3	12.01	21	7	12.28	21
Port Limon	3	9.17	21	9	17.95	18
Swamp Mouth	3	11.49	19	5	12.16	16
Zent	20	7.33	19	2	11.02	22
Siquirres	60	8.38	10	5	10.55	19
Dos Novillos	122	12.95	18	.....	.....	.....
Guapiles	300	17.44	18	3	10.59	24
Cariblanco (Sarapiqui)	895	16.18	28	5	20.00	27
San Carlos	161	12.64	24	5	17.48	26
Las Lomas	266	12.05	11	3	14.96	16
Peralta	332	8.85	21	5	12.75	24
Turrialba	620	12.24	10	8	10.63	22
Juan Viñas	1,040	5.16	19	7	8.50	17
Santiago	1,100	8.26	17	2	9.41	22
Paraiso	1,336	9.33	9	2	6.42	20
Cachi	1,020	9.37	21	2	.....	.....
Las Concavas	1,337	5.32	22	2	6.65	23
Cartago	1,451	4.92	10	2	4.80	16
Tres Rios	1,300	3.94	10	14	7.99	16
San Francisco Guadalupe	1,187	8.94	15	7	10.27	22
San Jose	1,160	8.39	15	14	9.72	23
La Verbena	1,140	4.21	19	7	9.49	20
Nuestro Amo	791	2.32	10	7	7.91	15
Alajuela	950	5.32	11	3	10.35	15
San Isidro Alajuela	1,346	6.61	19	2	16.14	22
Las Cañas	780	3.90	7	.....	.....	.....

TABLE 4.—*Observations taken at Port Limon and Zent, July, 1903.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	° *F.*	° *F.*	° *F.*	%
Port Limon	29.74	29.95	29.84	66.2	89.1	77.9	83
Zent	.....	.....	.....	65.3	89.6	78.0	87

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	6 inches.	12 inches.	24 inches.
	%	*Hours.*	*Inches.*		° *F.*	° *F.*	° *F.*
Port Limon	.....	.....	9.17	21	.....	.....	.....
Zent	82	124.85	7.33	19	80.4	80.4	80.4

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

July, 1903.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inches.*	° *F.*	° *F.*	° *F.*	%	*Ins.*		
Chihuahua	4,684	25.21	95.0	66.2	80.6	38	0.97	e.	.....
Guadalajara (Obs. del. Est.)	5,186	24.92	86.0	53.6	70.9	73	10.45	nw.	.....
Guanajuato	6,640	.....	.....	.....	.....	.....	.....	.....	.....
Leon (Guanajuato)	5,906	24.26	85.6	55.6	69.4	64	5.89	se.	.....
Mazatlan	25	29.84	91.9	75.2	82.4	76	2.74	nw.	.....
Merida	50	.....	.....	.....	.....	.....	.....	.....	.....
Mexico (Obs. Cent.)	7,472	23.06	77.4	52.2	62.2	70	5.32	ne.	ne.
Mexico (E. N. Agric.)	7,442	.....	.....	.....	.....	.....	.....	.....	.....
Monterey (Seminario)	1,626	.....	.....	.....	.....	.....	.....	.....	.....
Morelia (Seminario)	6,401	23.92	77.9	53.6	62.6	79	6.94	se.	ne., se.
Pachuca	7,959	.....	.....	.....	.....	.....	.....	.....	.....
Puebla (Col. Cath.)	7,108	23.36	75.6	49.3	61.0	78	9.80	ene.	.....
Puebla (Col. d Est.)	7,118	23.34	75.4	46.4	62.1	75	5.67	n.	.....
Queretario	6,070	.....	.....	.....	.....	.....	.....	.....	.....
Toluca	8,812	21.96	76.1	46.4	57.2	76	6.53	se.	.....
Zacatecas	8,015	22.57	79.2	45.5	61.2	69	1.99	e.	.....
Zapotlan	5,078	.....	.....	.....	.....	.....	.....	.....	.....

*The monthly barometric means are reduced to the international standard of gravity.

Chart I. Tracks of Centers of High Areas. July, 1903.

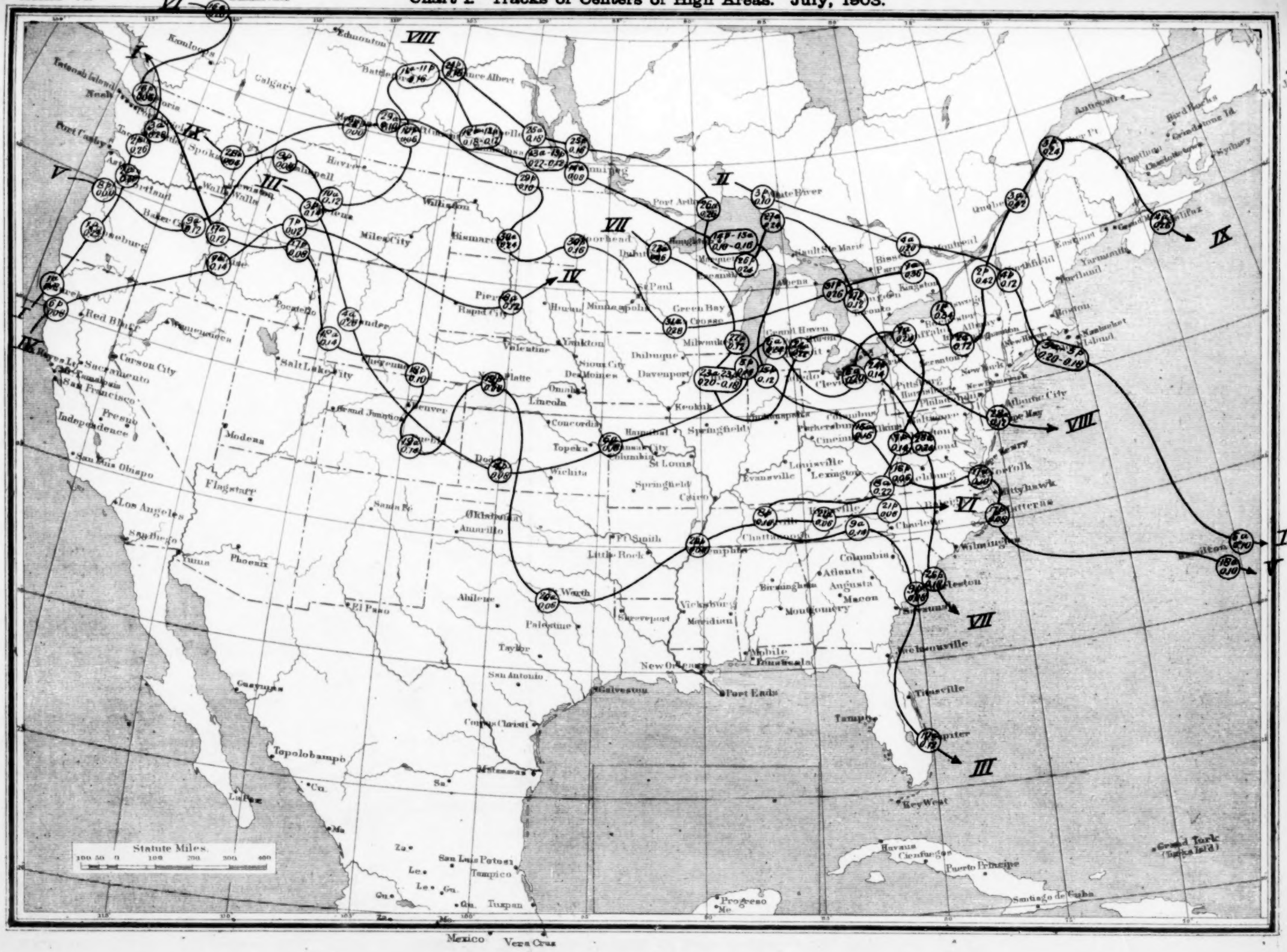
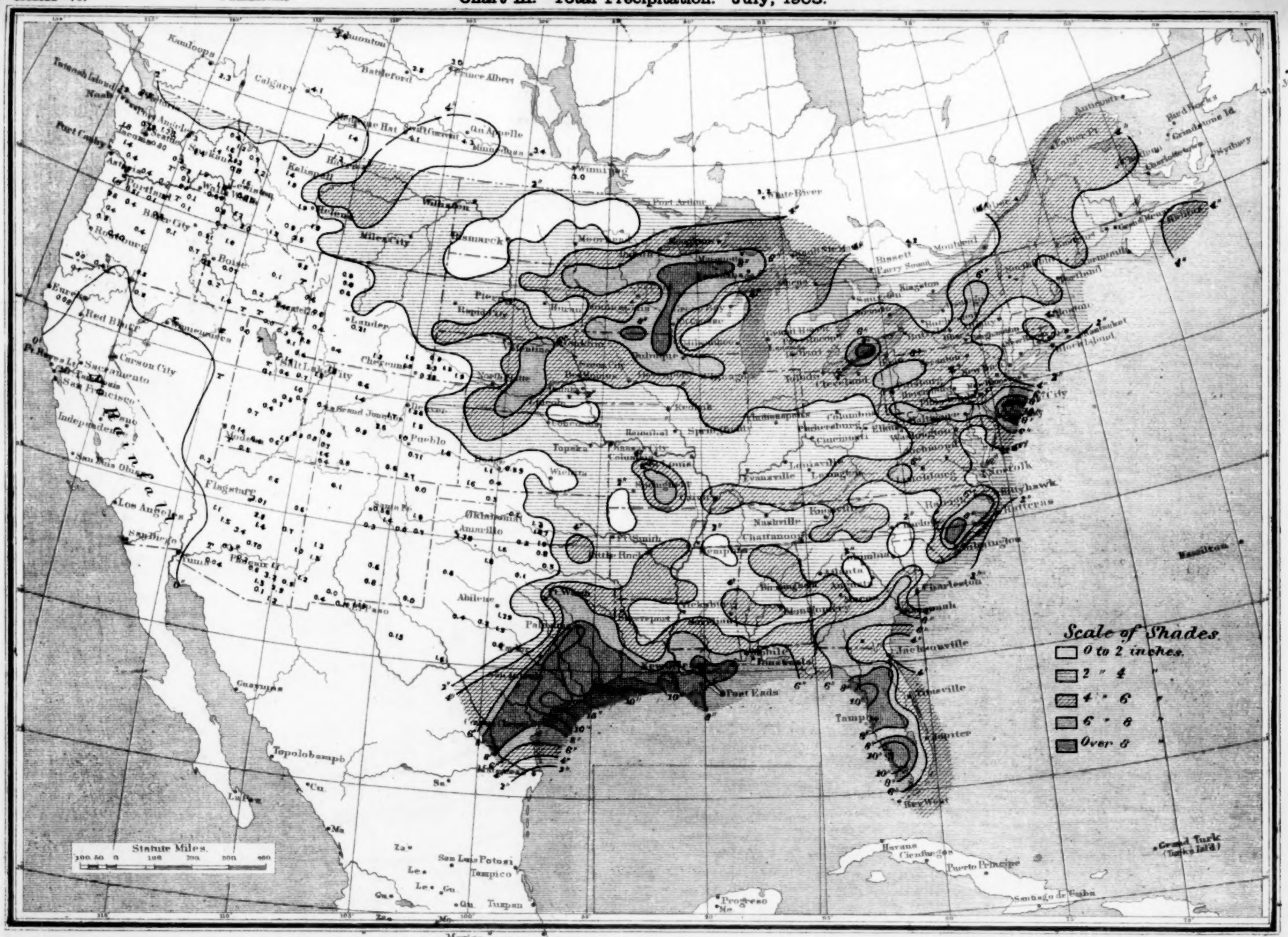

Statute Miles.
100 50 0 100 200 300 400
Bakersfield
Roseburg
Red Bluff
Carson City
Salt Lake City
Grand Junction
Modena
Flagstaff
Los Angeles
San Diego
Yuma
Phoenix
El Paso
Abilene
Fort Worth
Palestine
Taylor
San Antonio
Galveston
Corpus Christi
Brownsville
Topolobampo
La Paz
Mazatlan
San Luis Potosi
Tampico
Tuxpan
Mexico
Vera Cruz
Progreso
Havana
Cienfuegos
Puerto Principe
Santiago de Cuba
Grand Turk (Turks Isld)
Key West
Tampa
Jacksonville
Tallahassee
Pensacola
Mobile
New Orleans
Port Eads
Vicksburg
Meridian
Shreveport
Monroe
Little Rock
Fort Smith
Memphis
Amarillo
Oklahoma
Santa Fe
Wichita
Topeka
Kansas City
Omaha
Lincoln
Concordia
Hannibal
Springfield
St Louis
Cairo
Evansville
Louisville
Lexington
Cincinnati
Columbus
Atlanta
Birmingham
Augusta
Macon
Montgomery
Charleston
Wilmington
Norfolk
Hatteras
Chattanooga
Nashville
Huntsville
Decatur
Florence
Corinth
Jackson
Greenville
Yazoo City
Natchez
Baton Rouge
Lake Charles
Houston
Austin
Waco
Dallas
Denver
Pueblo
Colorado Springs
Cheyenne
Rawlins
Green River
Salt Lake City
Ogden
Pocatello
Boise
Spokane
Walla Walla
Lewiston
Helena
Miles City
Bismarck
Huron
Rapid City
Yankton
Valentine
Sioux City
Des Moines
Davenport
Dubuque
Omaha
Keokuk
Quincy
Peoria
Springfield
Terre Haute
Indianapolis
Fort Wayne
Toledo
Cleveland
Akron
Pittsburg
Parkersburg
Huntington
Charleston
Lynchburg
Roanoke
Greensboro
Raleigh
Wilmington
Columbia
Augusta
Savannah
Jacksonville
Tallahassee
Pensacola
Mobile
New Orleans
Port Eads
Galveston
Corpus Christi
Brownsville
Monterey
Saltillo
Zacatecas
Durango
Chihuahua
Guaymas
Topolobampo
La Paz
Mazatlan
San Luis Potosi
Tampico
Tuxpan
Mexico
Vera Cruz
Progreso
Havana
Cienfuegos
Puerto Principe
Santiago de Cuba
Grand Turk (Turks Isld)
Key West
Tampa

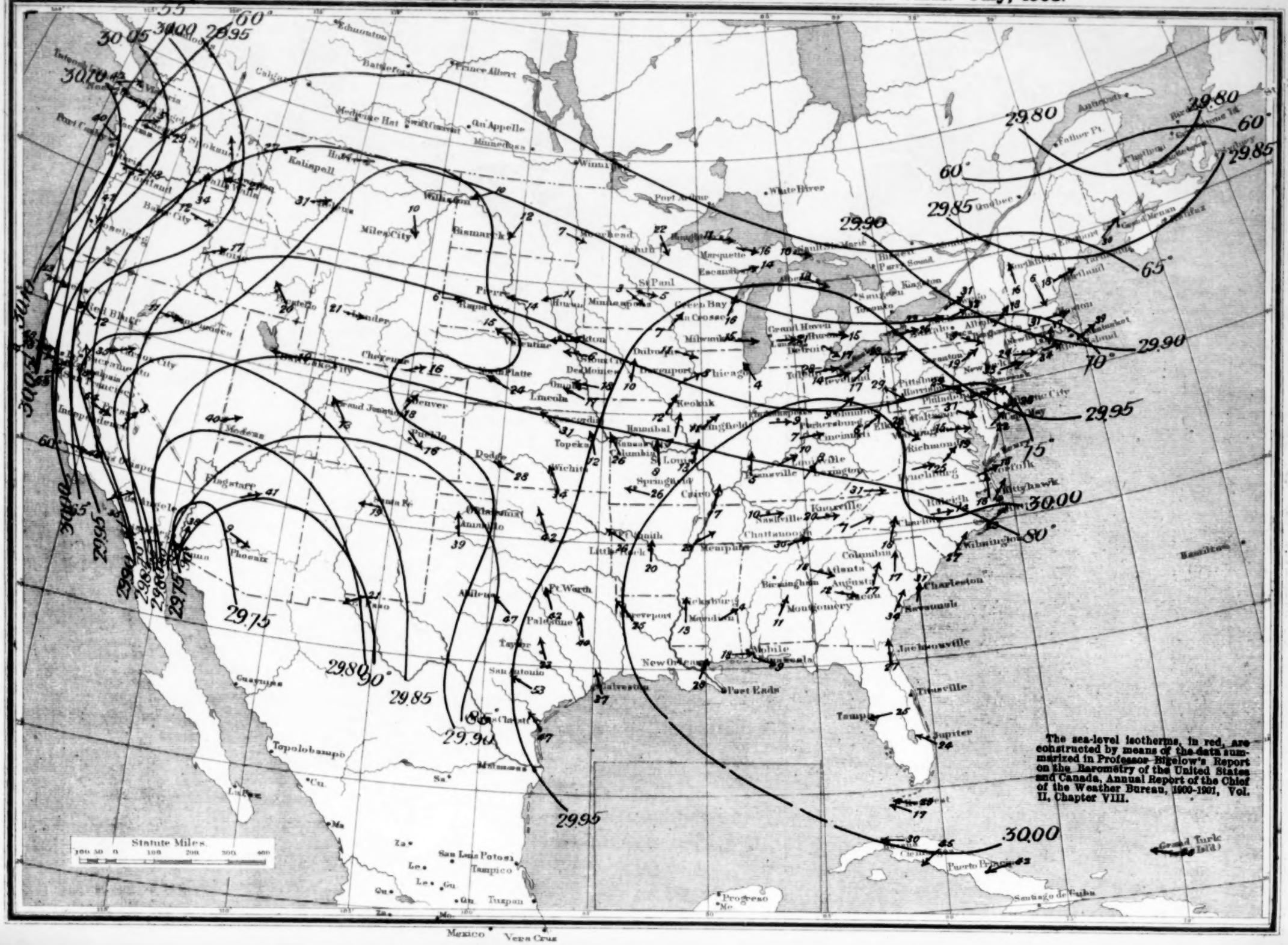
Chart II. Tracks of Centers of Low Areas. July, 1903.

Chart III. Total Precipitation. July, 1903.

Chart III. Total Precipitation. July, 1903.

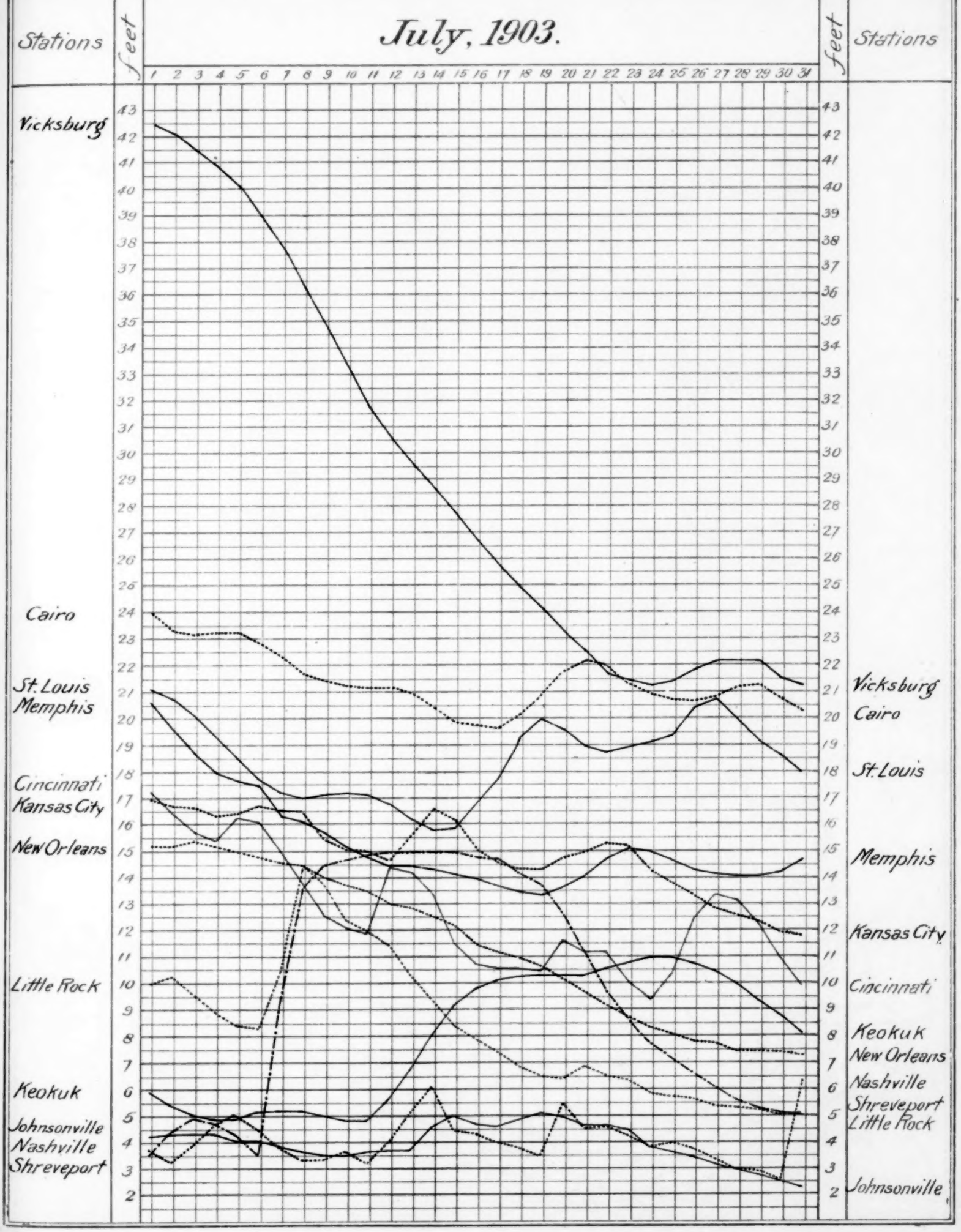


• Baxkerville **Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. July, 1903.**



The sea-level isotherms, in red, are constructed by means of the data summarized in Professor Bigelow's Report on the Barometry of the United States and Canada, Annual Report of the Chief of the Weather Bureau, 1900-1901, Vol. II, Chapter VIII.

Chart V. Hydrographs for Seven Principal Rivers of the United States. July, 1903.



• Barkerville **Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. July, 1903.**

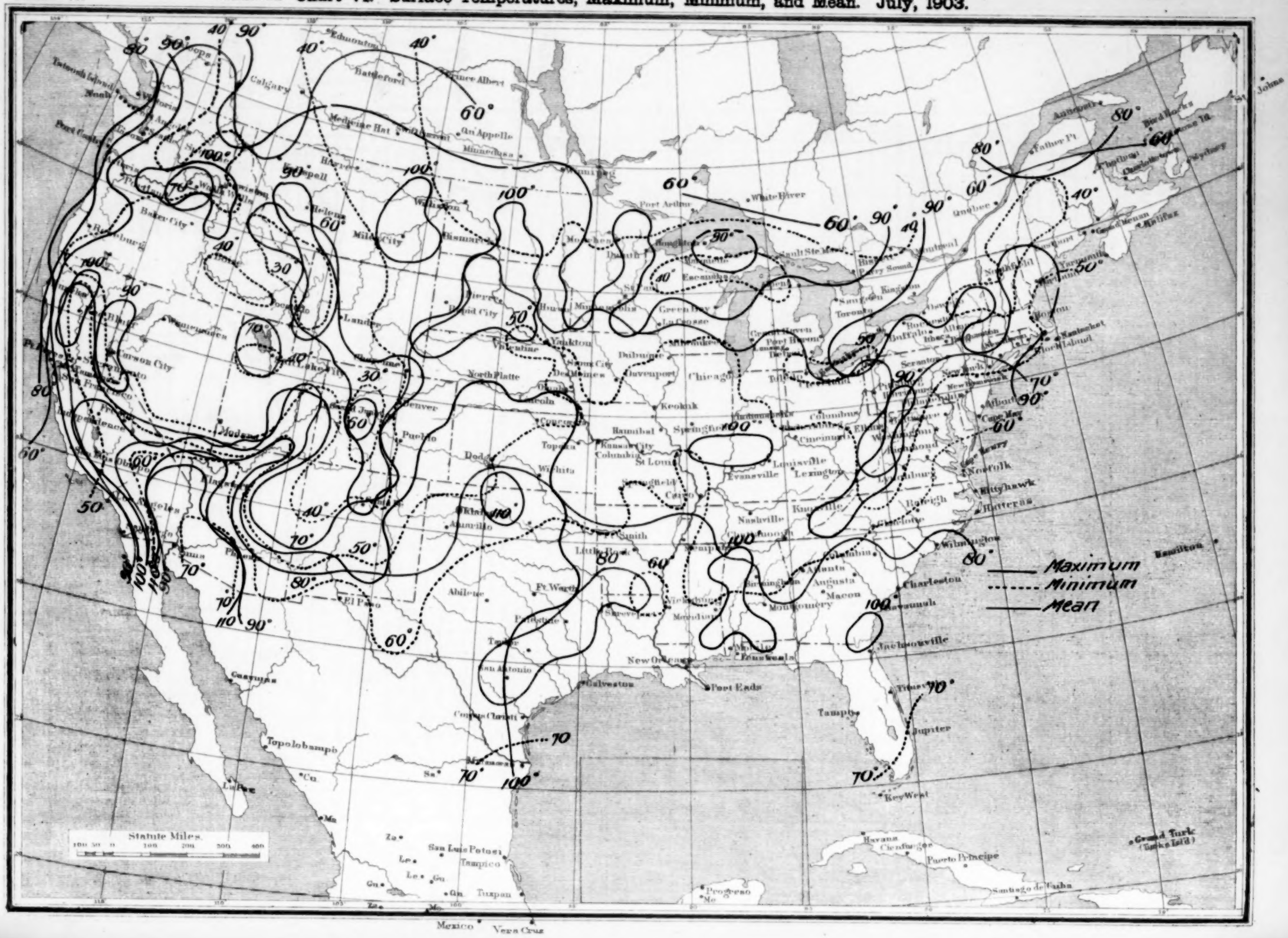


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Chart VII. Percentage of Sunshine. July, 1903.

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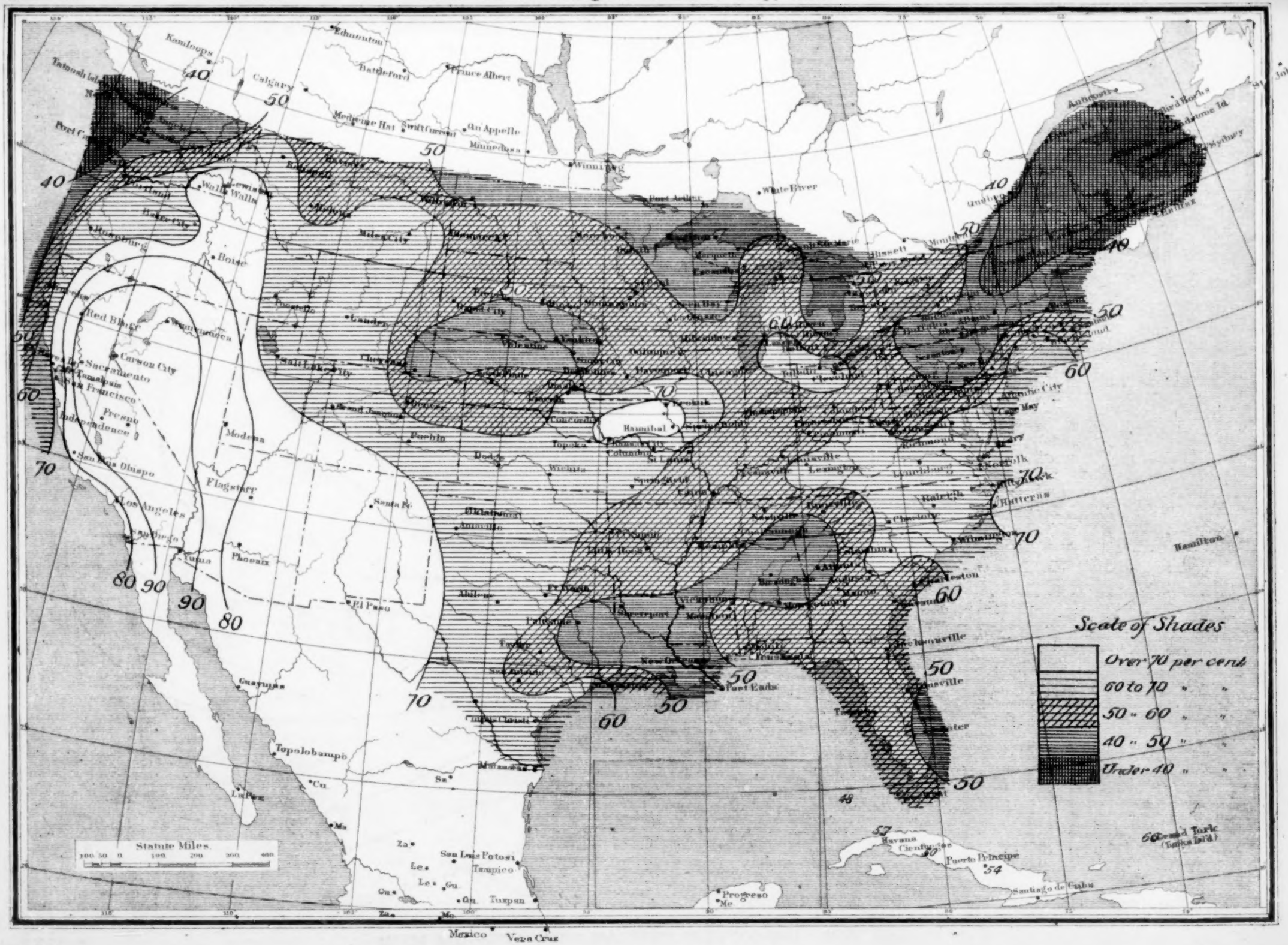

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Chart VIII. Isobars and Isotherms at 10,000 feet. July, 1903.

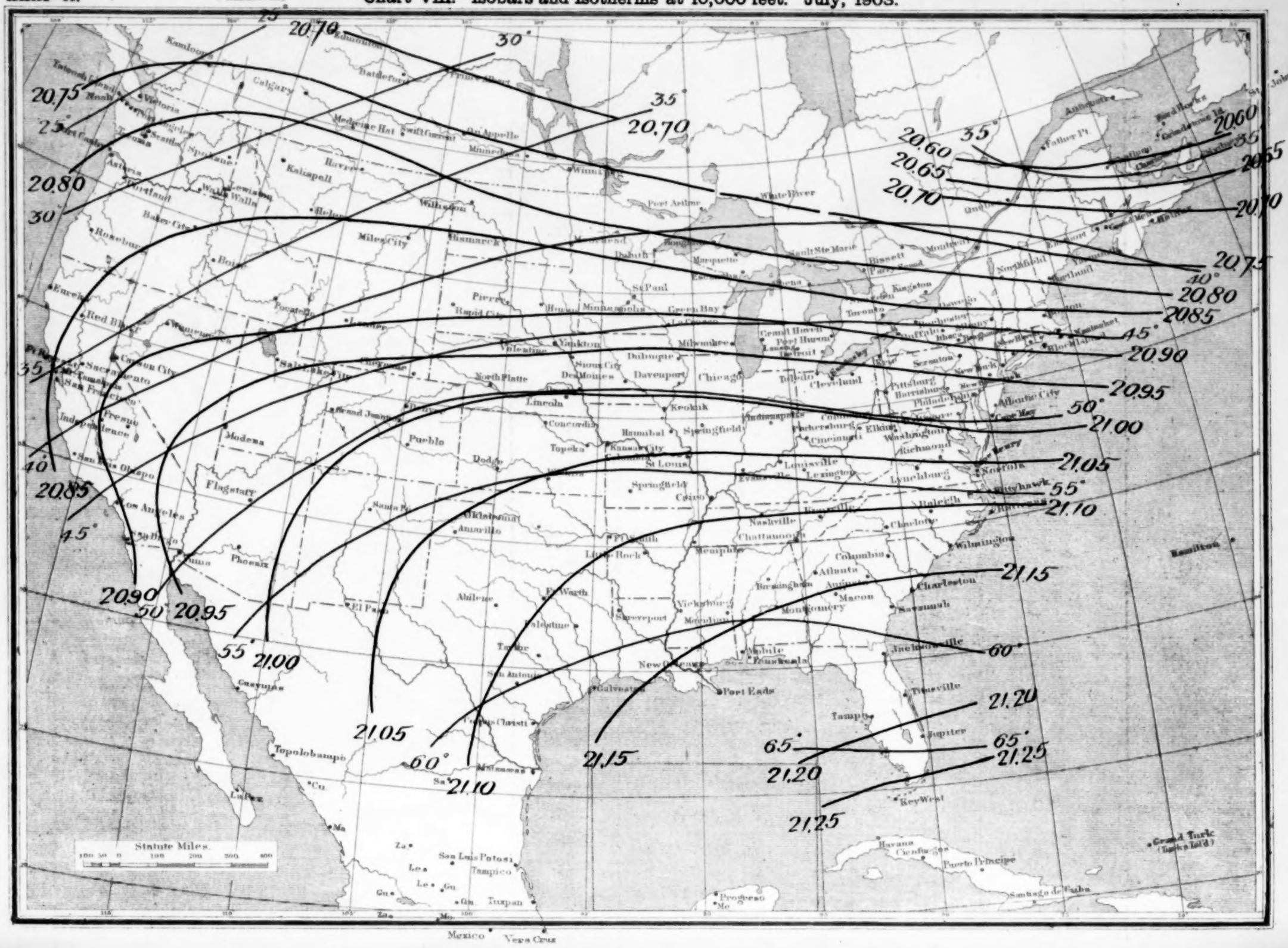

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Chart IX. Isobars and Isotherms at 3,500 feet. July, 1903.
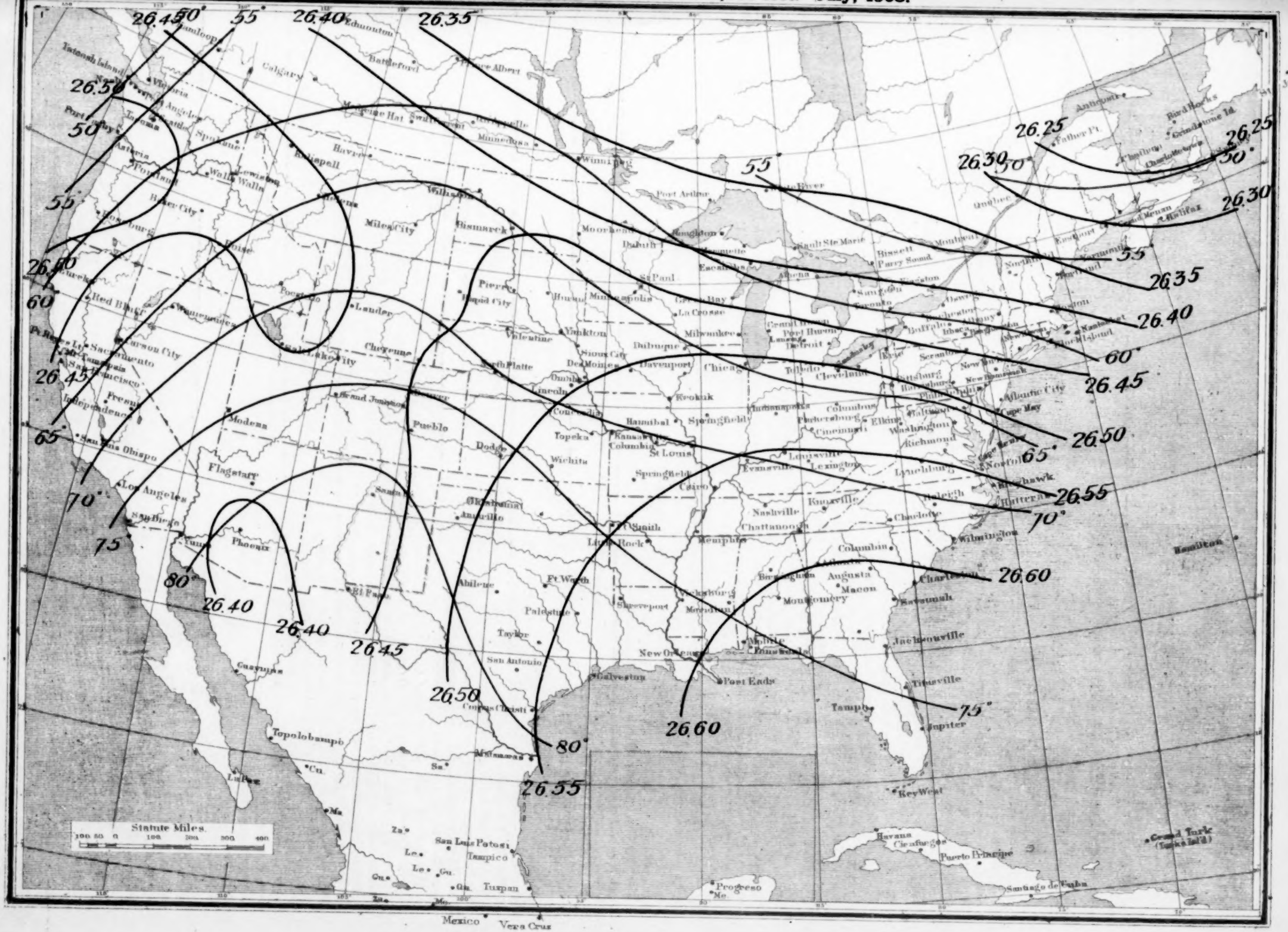
Chart IX. Isobars and Isotherms at 3,500 feet. July, 1903.